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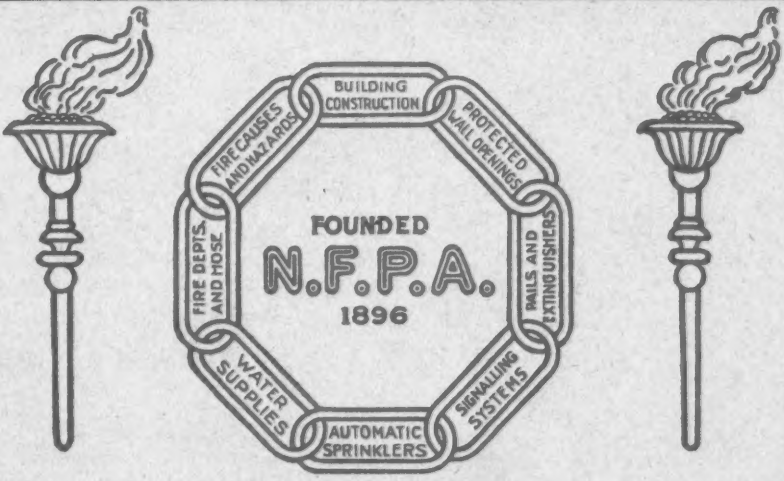
OF THE

NATIONAL FIRE PROTECTION ASSOCIATION



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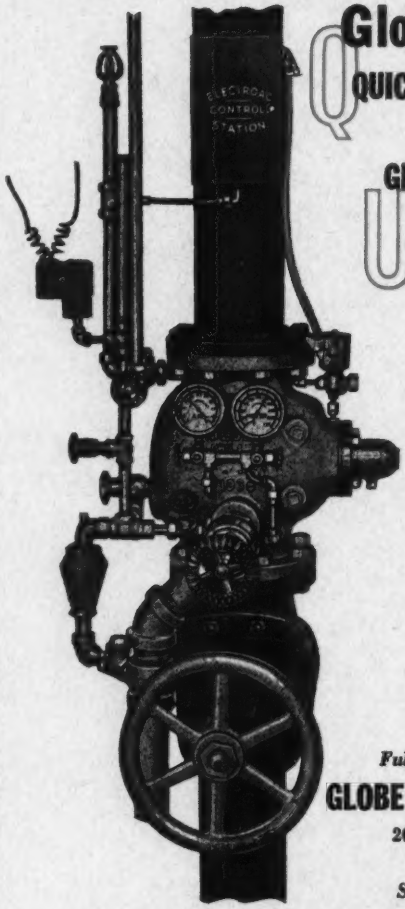

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Vol. 30 October, 1936 No. 2

QUARTERLY

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Reports of fires appearing in the Quarterly are copies of or extracts from written reports forwarded to the Association. This Association, as a body, is not responsible for the statements or opinions of any of its members.

The blazing ruins of the C. A. Webb plant in Baltimore in which five persons lost their lives on July 11, 1936, due to an explosion of flammable liquids stored on the premises in spite of previous refusal of city authorities to grant a permit for this storage. Benzol was being unloaded from the tank car at the right when the explosion occurred. See page 162 for account of this fire.

The Quarterly

Vol. 30 October, 1936 No. 2

Fire Prevention Week 1936

The 1936 Fire Prevention Week campaign has surpassed in the extent of its observance all similar campaigns in previous years. The extent of the popular interest in the annual observance of Fire Prevention Week, increasing year by year, is an encouraging indication of the success of the long continued educational efforts by the N.F.P.A. and its constituent members. Those concerned with the engineering aspects of fire protection sometimes marvel at the recurring interest in fire prevention during the annual October campaign. Each year the public is told the same story, but memories are short and each year the same message is needed. Fire Prevention Week is increasingly becoming the starting point for a year-round fire prevention campaign rather than merely an isolated observance to be forgotten the following week.

Among the many angles of the observance of Fire Prevention Week, one of the most valuable and of most lasting benefit is the attention given to this subject in the schools. School children throughout the United States and Canada hear the fire prevention message at this time. Some indication of the extent of the observance of Fire Prevention Week in schools may be obtained from the N.F.P.A. Executive Office correspondence with teachers. During the period just before Fire Prevention Week the N.F.P.A. office received every day between 50 and 100 individual requests from teachers who asked for material to help them present the subject of fire prevention to their classes. This represents only a small fraction of the interest displayed by teachers and school authorities, as many other sources of fire prevention information are available to schools through local N.F.P.A. members and fire departments, state fire marshals, and other sources.

When Mr. T. Alfred Fleming, Chairman of the N.F.P.A. Committee on Fire Prevention and Clean-up Campaign, presents his annual report on Fire Prevention Week at the 1937 annual meeting a complete story of the accomplishments of the week will be told. We cannot wait until next May, however, to reflect upon the observance of Fire Prevention Week 1936, to express appreciation of the contribution to this campaign made by N.F.P.A. members and thousands of other interested individuals, and to remark that all this effort is having a cumulative effect in educating the public and reducing loss of life and property by fire.

Air Conditioning

Air conditioning, which is growing rapidly and according to predictions will eventually change the living and working conditions of a considerable proportion of the people in the United States, like other major developments, brings its special fire hazard problems.

In accordance with the Association's policy of watching new developments and endeavoring to guide them along safe lines rather than awaiting an adverse fire experience that might dictate drastic regulations, the N.F.P.A. Committee on Blower Systems has in the 1936 revision of the regulations under its jurisdiction prepared advisory rules for the guidance of those installing air conditioning equipments. The industry itself is fundamentally interested in securing safe installations, and public authorities are closely watching the development. Some fires have already been reported in connection with air conditioning equipments where the duct system served to spread fire and hot gases rapidly through the building. However, through the observance of the N.F.P.A. recommendations, such occurrences can be minimized and with the coöperation of the industries concerned it appears likely that the Association may have a major influence in guiding this entire development along safe lines.

Air conditioning may cause various changes which concern fire protection as well as the installation of the air conditioning equipment itself. Windowless buildings have already been erected in several places and appear likely to increase in number now that air conditioning makes outside windows unnecessary or even undesirable in respect to building ventilation. Fire departments traditionally rely upon access through windows and if buildings without windows become general, it may be that an entirely new technique of fire fighting will have to be developed.

Another by-product of air conditioning of fire protection interest is the large consumption of water. The *Engineering News Record* reports that the increased consumption of water for air conditioning in the business district of Lincoln, Neb., during the past summer was such as seriously to overtax the sewer system. This particular difficulty was remedied by connecting cooling water discharge to storm sewers instead of sanitary sewers, but it appears that when air conditioning is extended to include all the principal business properties of the city there will be an additional demand for cooling water amounting to 7,000,000 gallons a day, or approximately 5000 gallons per minute, which will practically double the normal water consumption in the business district. Such an increase in water consumption may seriously tax the available supply and accordingly reduce the water available for fire protection. The progressive officials in charge of Lincoln's water supply will doubtless meet this situation, but if similar increased demand for water occurs on a national scale it may be that the available supplies for fire protection will be seriously jeopardized in many communities.

Too True To Be Funny. The compounding of errors that is so often noted in the reports of large loss fires is illustrated in extreme form in the report of a recent farm fire. Were it not for our previous experience the story of this fire would be almost beyond belief, particularly so as the individuals involved would have appeared to be above average intelligence and had given some thought to preparedness for fire.

The buildings involved were a typical New England farm group. Dwelling, woodshed, chicken house, garage and barn were built together in a long line, making in effect a single frame structure. The barn during the winter was in use as a workshop. A home-made stove constructed from an old oil barrel had been installed, with a smoke pipe passing out the side of the building. Immediately above the stove was the hay loft. Strangely enough, this stove had been operated for two previous winters without causing trouble. The room used as a workshop had the usual complement of shavings, paints, etc., not to mention a home-made power operated saw with a gasoline engine and a tank of gasoline. To make the picture complete, there was also stored in the barn a keg of gun powder used for blasting stumps and splitting logs.

On the morning of the fire the occupant started the stove as usual and after an hour or so of work left the barn to do an errand, leaving the lid on the top of the stove open to check the draft. A gusty wind was blowing at the time. Half an hour later the man, returning, saw smoke and rushed into the barn. His efforts with a fire extinguisher were ineffectual, as the extinguisher was of a type designed for use on gasoline and oil fires and was not suitable. Suddenly the hay loft flashed into flame, filling the barn with choking smoke. The man had difficulty in escaping, but finally succeeded in opening the door and getting out. Once outside he sat down to recover from the effects of the smoke. Realizing that the open door was giving draft to the fire he closed it, but at that moment the explosion of the keg of gun powder, which went through the roof, gave the fire ample draft. He telephoned an alarm and in due course some fifty farmer neighbors arrived, bringing the village fire fighting equipment, consisting of a portable motor-driven pump and hose of a type that is commonly used for fighting forest fires. Curiously enough, the fire seems to have progressed rather slowly, as if the fates had decided to give the amateur firemen a sporting chance.

The portable pump was placed over the well. The hose was laid and the men were about to start operations when it was discovered that the suction hose was too short. The whole outfit was then carried several hundred yards down a steep hill to a small stream. There was an ample supply of hose and this was laid to the fire. The man who usually operated the pump had gone to the city for the day and no one else present knew much about it. However, after Herculean efforts the pump was started. After replacing five lengths of hose which gave way one after another, a stream was brought into play.

In the meantime, realizing that the fire might not wait, a bucket brigade had been formed to retard the spread of fire along the sheds, and a dozen men were making furious efforts to remove the chicken house so as to make a break in the continuous wooden structure. Their efforts were unavailing until a one-armed carpenter arrived on the scene and with expert knowledge of construction loosened the timbers at a few critical points, whereupon the chicken house was quickly demolished. By this time the hose stream was put in operation, the fire was finally checked at this point and the dwelling was saved.

* * * * *

There Ought to Be a Law

A naïve faith in law as a cure for every sort of evil largely persists despite long experience to show that laws are effective only when adequately supported by public opinion. Laws are much needed in the interest of fire prevention and fire protection — more laws and better laws. But there are limits as to what may be accomplished by legislation, no matter how worthy the purpose. Witness the following item from the New York *Journal of Commerce:*

> For the purpose of protecting homes and outbuildings from fires, officials of Interlaken, N. J., a shore resort, have adopted an ordinance limiting the height of grass on lawns to four inches. Brush and weeds are made illegal by the measure.

We assume that the ordinance in question is directed to the owners of the grass, rather than the grass itself, but even so we are reminded of the grass seed racket reported by the Better Business Bureau. It appears that last summer gullible New York suburbanites bought large quantities of colored sawdust at a high price, which was represented as a special kind of grass seed which would grow grass to a height of two inches and then stop growing, so that no lawn mowing would be required.

Speaking seriously, grass fires present a troublesome problem, and one demanding the consistent attention of municipal authorities. Laws may be needed to give the necessary backing to the fire department in its efforts to eliminate the hazard, but no law in itself will prevent the growth of grass, and grass fires can be controlled only by constant vigilance.

Fire Department Practice in Foreign Cities.

By Boris Laiming,
(Member N.F.P.A.)

Physical and social differences in different cities call for a divergence in fire department practice that must be considered when making comparisons. The practice and essential details of fire department organization in foreign cities differ from the practice in the United States and Canada because of fundamentally different conditions.

However, certain practices developed by individual cities in an effort to meet major local problems are enlightening to the handling of related problems when they present themselves elsewhere. In this article, the practice and essential details of fire department organization in representative foreign cities are discussed, and such features of that practice and organization are emphasized as may be of value to those who are interested in fire protection of American cities.

This study is based primarily upon data contained in official reports of foreign fire departments, on authoritative fire protection publications, and on personal communications and observations available to the writer. The coöperation of the chief officers of all the fire departments and others in supplying photographic illustrations and other data is hereby gratefully acknowledged.

A preliminary analysis of all the data available from about 30 large foreign cities showed that fire practice varied in many details in nearly all of those cities, but that a basic similarity existed in the general organization, methods, and types of equipment in cities within the same country or group of neighboring states. Therefore, to avoid excessive detail, the following leading cities were selected as representative of the organization and fire practice in their respective countries: London and Birmingham for England and British dependencies, except Canada; Paris for France; Berlin, Dresden, Hamburg, Munich and Düsseldorf for Germany; Milan for Italy; Moscow for the Union of Socialistic Soviet Republics (Russia); Vienna for Austria; Amsterdam for Holland; Oslo for Norway; Stockholm for Sweden; and Tokyo for Japan.

For the purpose of clarity it was found expedient to handle the descriptive material under the following principal headings: General Organization; Distribution of Fire Forces; Assignments; Significance of Structural Conditions; Fire Stations; Fire Apparatus; Fire Hose and Hydrants; Maintenance and Technical Work; Drills and Training; Fire Prevention; and Fire Alarm Systems.

Birmingham Fire Brigade.

Fig. 1. Fire Brigade Headquarters, Birmingham, England.

General Organization.

Fire departments in foreign cities may be grouped into the following classes, according to the general pattern of their organization. (1) Municipal fire brigades, wholly under municipal control, as in American cities; maintained in England, and in most British dependencies, Holland, Austria, and the Scandinavian countries; (2) Fire departments in Germany,* Italy and Russia, financed by cities or provincial communities, and organized as divisions of the national fire-police authority, deriving its powers from a national act affecting general organization, maintenance, standardization, minimum force requirements, and other matters; (3) Military fire brigades in France, financed by municipalities, reporting on personnel matters and training to the War Department, and to the supreme police authority on matters of operation and fire prevention; and (4) Municipally financed and operated fire departments in Japan, subject to general supervision by the supreme police authority, and resembling American fire departments in their system of company distribution.

The great majority of foreign fire departments are operated on a two-platoon basis, whereas a modified shift system exists in some British cities and in France. Pension provisions amounting to one-third or one-half pay for an average of 20 years of service, with increases provided for additional years of service prevail in most countries. Technical matters pertaining to general maintenance, acquisitions, tests, standards, and fire prevention are in the hands of technical experts or boards consisting of the chief officers.

*Feuerschutz Vol. 15, No. 12, December, 1935.

Vienna Fire Department.

Fig. 2. New district fire station at Vienna, Austria, housing seven pieces of apparatus and with a personnel of 27 men on duty.

Distribution of Fire Forces.

The principle on which fire department organization and distribution of the force is based in nearly all foreign fire departments may be stated as self-sufficiency of the fire station. This system is somewhat modified in Vienna, and in Japan, in which latter country a system more closely resembling that adopted by American cities is in effect. Contrary to the American system of company organization, it is considered abroad that a fire station must in principle be so equipped and manned as to be self-sufficient in handling any type of ordinary fire within its district. In this manner, pumpers, ladders, squads, etc., are not segregated into separate operating units, but all the equipment is carried in each station, forming an operating entity under orders of the station officer. The station entity consists as a rule of two or three motor apparatus units comprising two pumps and an aerial ladder, with a personnel varying from 13 to 22 men. Assignments up to 6 pieces of apparatus and 27 men are run in Vienna, and nearly double that number in Japan.

It has been demonstrated by the writer in a previous article* that the number of fire fighting units per 100,000 population averages 3 in foreign cities, as against an average of 9 comparable units of 5 to 8 men in American cities. This ratio, however, does not reflect correctly upon the comparative degree of protection afforded congested city areas in American and foreign cities, as will be shown below. The larger portion of fire companies in American cities falls upon extensive residential areas, with a low concentration of population, in which great distances, combustible construction, and a six times greater per capita frequency of fires than in foreign cities necessitate the maintenance of an adequate fire force.

*Fire Problems of American and Foreign Cities. QUARTERLY, January, 1936, page 202.

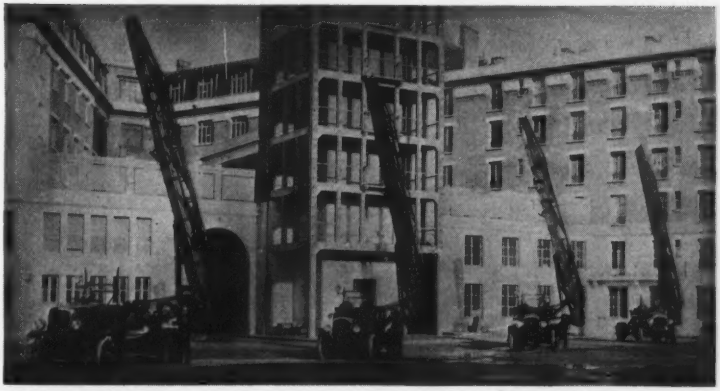
Table I. Distribution of Fire Forces Within Two-Mile Radius in Central Closely Built Areas.

City	Fire Stations	Firemen on Duty*	Units**	Motor Apparatus in Service: Pumpers	Hose Wagons	Aerial Ladders***	Booster, Tank, and Ladder Combinations	Squad, Rescue, and all other Auxiliary
Foreign Cities:								
Berlin	12	210	30	12	..	12	..	9
Birmingham	7	108	19	12	..	3	7	1
Hamburg	9	199	27	9	8	8	1	4
London	18	205	45	34****	..	7	2	3
Milan	6	130	20	9	..	2	9	2
Moscow	14	252	42	16	..	14	12	2
Paris	14	369	49	18	3	14	14	8
Vienna	11	227	42	15	6	6	11	15
Average	11	212	34	16				
American Cities:								
Brooklyn	33	320	40	27	12	12	..	3
Chicago (central)	33	224	43	31	1	9	..	3
Chicago (stockyards)	19	116	22	15	..	5	..	2
Los Angeles	20	205	31	20	17	10	..	8
Upper Manhattan*#*	35	335	48	28	11	20	..	..
Average	28	240	37	24				
Lower Manhattan*##*	43	434	58	38	19	16	..	5

*Chief officers not included.
**Fire boats and salvage units and men not included.
***Includes city service trucks in American cities.
****Includes 16 dual purpose machines (pump and ladder, Fig. 6).
*#*Area, 2x6 miles.
*##*Area, 6 square miles.

Table I, compiled from reports and maps of the respective cities, is designed to show the number of stations, firemen, fire fighting units, and apparatus forming the immediate protection of congested areas of those cities within a two-mile radius. Central portions of foreign cities have been selected for the tabulation which do not include any abnormal terrain, and are closely built upon. Similar central areas are taken for comparison in Upper Manhattan (New York), Brooklyn, Chicago, Los Angeles, and the Chicago stockyards district. The area of Upper Manhattan between 34th and 152nd streets is equal to the other areas under consideration, but 6 miles long and 2 miles wide instead of a circle. The table includes also a comparison with Lower Manhattan, an area only half that size, but comprising the world's greatest concentration of values, and buildings up to 1100 feet in height.

Table I shows that central districts of large foreign cities are protected by as many fire fighting units and men as congested value districts of American cities, whereas the apparatus is concentrated in fewer stations and pump-



Paris Fire Brigade.

Fig. 3. Rear view of the newest station in Paris and its drill yard and tower. The apparatus shown are Magirus 100 ft., 4 sectional, motor-raising aerials on French (Delahaye) chassis.

ing capacity is considerably smaller. Thus the conclusion may be drawn that a considerably larger personnel is available in foreign cities to handle the available pumping capacity of the motor apparatus than in American cities, especially when a larger number of smaller hand lines are operated and heavy stream appliances are not in use.

Assignments.

In accordance with the relative uniformity of building construction throughout the closely built portions of foreign cities, as compared with American cities, first alarm assignments are fairly uniform. Table II illustrates the practice regarding assignment in a representative group of foreign cities, and contains a comparison with typical assignments in American cities. That practice is modified in certain congested areas, or for specially hazardous individual properties, or when the nature of the calls indicates a fire of serious proportions. It appears that certain reliance is placed in foreign cities upon identification of the nature and seriousness of the fires before a full (special)* assignment responds. The safety of such procedure is in contradiction to the practice recommended by the National Board of Fire Underwriters in the United States, but apparently works out in a satisfactory manner in foreign cities as a result of the relatively slow progress of most fires under prevailing favorable structural conditions. The general absence of fire escapes on buildings, of the type provided in American cities, necessitates a closer distribution of ladder equipment of suitable height, and fits into the scheme of uniform organization of fire stations. Special purpose equipment, such as searchlights,

*Last two columns in Table II.

Table II. Response to First Alarms.*

City	Regular Assignment: Stations from Which Apparatus Responds	Fire Fighting Units**	Firemen***	Total Motor Apparatus Responding	Hose Carriers	Pumps	Aerial Ladders or Service Trucks	All other Apparatus	Feet of Hose Carried	Special Assignment to important properties or report of serious fire: Units	Men
Amsterdam	2	2–3	16–20	2–3	2	2	0–1	..	....	..	....
Berlin	1	2	15	2	2	1	1	..	2500	4–6	30–45
Copenhagen	1	3	18	3	2	1	1	1	....	..	....
Dresden	1	2	17	2	2	2	1	..	2900	4–6	34–51
Hamburg	1	3	20	3	2	1	1	1	2500	4–6	40–60
London	2–3	3–5	15–25	3–5	3–4	2–4	0–1	0–1	3200	..	40–60
Milan	2	2–3	18–22	2–3	2	2	0–1	..	....	By order	....
Moscow	1	3	18	3	3	1–2	1	1	2600	..	....
Munich	1–2	3	20	3	2	2	1	..	3200	6	40
Paris	1	3	22	3	2	2	1	1	3000	Up to 9	Up to 90
Tokyo	4–6	8–9	56–60	8–9	8	6–8	0–1	2–0	8000	..	....
Vienna	1–3	5	27	5–6	5	2–3	1	2–3	5750	..	....
New York:											
High Value....	4–6	6–7	48–56	8–10	6–8	4	2	2–4	8000	..	....
Mercantile	3–5	5	30–35	6–7	4–5	3	2	1–2	5000	..	....
Outlying	2–3	3	15–18	3–4	2–3	2	1	..	2500	..	....
Los Angeles:											
High Value....	4–5	7	45–49	11	8	4	2	5	8000	..	....
Hollywood	2–3	3–4	18–24	4–5	3–4	2–3	1	1–2	5000	..	....

*Assignment is the same for all districts in foreign cities except outlying.
**Salvage units not included.
***Chief officers not included.

rescue squads, wrecking trucks, hose tenders, etc., is maintained at headquarters or other suitable locations. In Japan, where wood construction is prevalent, assignments as large or greater than in American cities are run on first alarms.

Significance of Structural Conditions.

In the majority of foreign cities buildings are of masonry or concrete construction, frequently separated by unpierced fire walls and divided into sections by masonry walls. Building heights range rather uniformly between 3 and 7 stories in congested areas, generally lower in adjoining residential sections, and practically nowhere exceed 100 feet. Wooden sheds and similar one-story structures are found occasionally in yards. The prevailing roofing materials are tile or metal. A large proportion of wooden construction is found in Sweden, Norway, and in outlying sections of Russian cities; in the latter it is limited to two stories in height. Wooden construction is widespread in Japan, but seldom exceeds two stories in height. The effect of wooden construction upon the general fire hazard is demonstrated by the fact that

London Fire Brigade.

Fig. 4. Combination pumper and hose wagon of the London Fire Brigade equipped with a 720-gallon pump and 120 horse power motor. It carries six men, 800 feet of hose, 40-foot extension ladder, and breathing apparatus.

serious conflagrations, comparable in area to those occurring in North American cities, have taken place in the past twenty years only in the above mentioned group of countries where wooden construction is extensive or widespread. In the major portion of Europe, however, wooden construction and combustible roofing, which constitute the principal conflagration hazard of American cities, are present only to an insignificant degree.

From a total of 22,075 buildings in the city of Stockholm, Sweden, 10,484 are reported to be constructed of wood, and a similar condition prevails in the city of Oslo, Norway. This is coincident with a relatively high fire loss per capita in those cities, as seen from the following table.

Table III. Annual Fire Losses Per Capita.

City	Year 1929	1930	1931	1932	1933	1934
Stockholm	$2.41	$2.58	$.70	$.49	$.59	$3.44
Oslo	5.48	1.07	3.55	1.50	1.99	3.26
England*	.98	.85	.79	.85	.90	.96
France*	.72	.41	.45	.76	...	.58
Italy*	.48	.35	.57	.41	.31	.56
Germany and Austria*	.08	.15	.58	...	.17	.32
U. S. Cities 250,000 to 500,000 population	2.70	3.04	2.51	2.01	1.46	1.50
U. S. Cities over 20,000 population	2.72	3.01	2.47	2.22	1.51	1.59

*Average for a group of cities.

Those figures are suggestive of a connection between losses and prevailing structural conditions in cities. The high losses in those Scandinavian cities cannot be charged to inadequacy of their public fire protection, as Oslo has the highest ratio of fire fighting units to population (6.5 per 100,000 population)* of any foreign city, and an excellent ratio per area (17 units on 6 square

*Fire Problems of American and Foreign Cities. QUARTERLY, January, 1936, page 202.

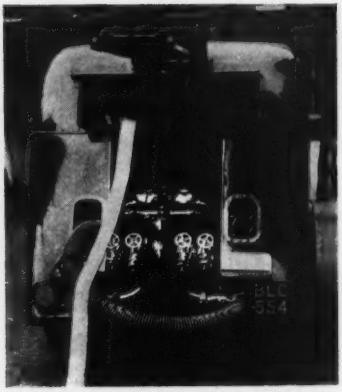


Fig. 5. Rear view of the new Dennis 700-gallon pumper of the London Fire Brigade.

miles), while the Stockholm fire department is rated as one of the best organized and best equipped in Europe.

Other interesting evidence bearing upon the relatively slow progress of most fires in foreign cities is afforded by the comparison of the results of two full size fire tests conducted in Washington, D. C., in 1928,* and in Leipzig, Germany, in 1935.** The former test was conducted under the auspices of the U. S. Bureau of Standards and the National Fire Protection Association in two brick-joisted buildings of a type frequently encountered in congested portions of most American cities. The buildings were of 5 and 2 stories respectively, with wooden interior, open elevator shafts and stairways. The test in Germany was made with a group of 5 condemned brick buildings, 2 to 4 stories in height, with wood plastered interior walls and floor beams, pitched slate roofs on wood rafters, and open wooden stairways.

The results of the tests showed that after fire had been set at several points on the ground floor, the American buildings became completely involved by fire via elevator shafts and stairways within 4 to 5 minutes; floors began to fall in 15 to 20 minutes; part of the front wall of the larger building collapsed in 28 minutes, and all the walls collapsed in 45 minutes. The progress of the fire in the buildings in Leipzig, on the contrary, was much slower. Fire was set in three different buildings, traveled up the wooden stairways, and involved the attics first. The plastered floor beams of all buildings held for hours before they began to collapse, and the comparatively early collapse of the roof structures did in no case cause any of the ceilings to be broken through.

Those tests are indicative of the fact that the joisted brick buildings of American construction present a much greater opportunity for rapid spread of fire within them than ordinary brick buildings with wooden floor beams of European construction. This emphasizes the necessity for more prompt attendance of fire fighting equipment in American cities, and hence closer spacing of fire stations, as illustrated in Table I. A greater probability of fires "getting away" from the fire department in the early stages seems to warrant

*Fire Test of Brick Joisted Buildings, N.F.P.A. QUARTERLY, Vol. 22, No. 1, July, 1928.
**Feuerschutz, February, 1936.

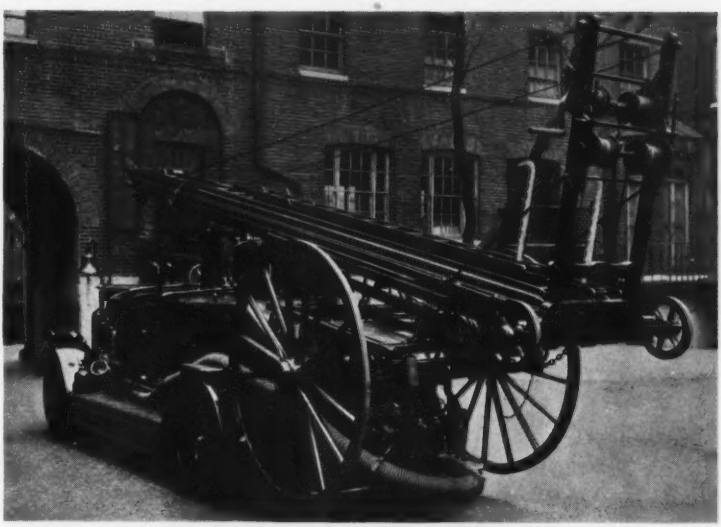


Fig. 6. Dual purpose combination pump and "escape" of the London Fire Brigade, carrying "first aid" water tank under pressure, with hose reel and 600 feet of standard 2¾-inch hose.

the use of fire apparatus of greater pumping capacity in American cities to properly supply heavy stream appliances should the fire be beyond control of small hand lines upon the arrival of the fire department.

Fire Stations.

In conformity with the general plan of distribution of the fire forces in foreign cities, fire stations are larger, as a rule, than they are in the majority of American cities. They are built to house at least two or three pieces of motor apparatus, and some stations can accommodate as many as 6 or 10 pieces of equipment in addition to repair shops, stores, chief officers' apartments, instruction rooms, and the usual quarters needed at fire stations maintained on the two platoon basis. Drill towers with smoke rooms, hose driers, etc., are provided in a large portion of the fire stations in continental Europe. Typical fire stations are shown in Figs. 1, 2, and 3.

Fire Apparatus.

In the past several years, revolutionary changes in fire apparatus construction have been made in foreign cities. The technical staffs of fire departments conducted extensive experiments with new models of fire apparatus, and directed their attention toward the development of types of apparatus which would meet the following principal requirements: limitation of the number

of apparatus through condensation of fire fighting entities; increase of their carrying capacity through reduction of weight, now possible with the use of light construction materials; standardization of the equipment; increase of the pumping capacity of engines, and heights of aerials; protection for personnel and equipment from the elements by the use of closed body designs; flexibility of operation through the application of automatic features; introduction of Diesel power as a measure of economy and reliability; reduction of operating costs by adoption of types of apparatus which may be manned by fewer men than heretofore; combining of several purposes into one automotive unit; and introduction of the new foam-air unit as part of the standard equipment. Influenced by local conditions, those efforts resulted in the development of several distinct types of fire apparatus in different countries illustrated in Tables IV and V, and Figs. 4 to 17.

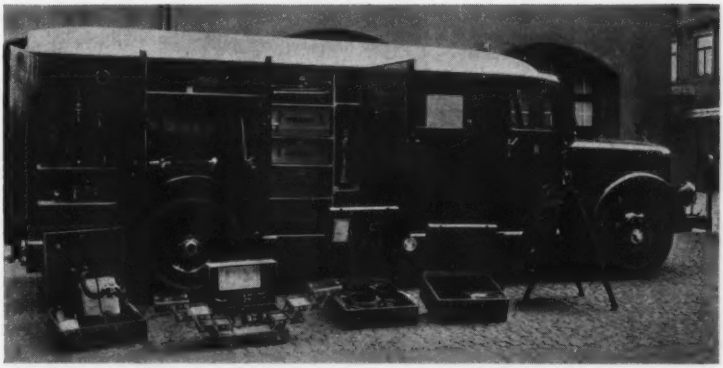
Table IV. Motor Pumping Engines and Booster Wagons.

City	Number	Max. Speed M. P. H.	Capacity Gallons per Min.**	Pressure, Lbs. per Sq. In.	Type	Motor H.P.	Motor Cyl.	Hose Carried Feet	Make
Birmingham	23	..	500	120	..	...	..	...	...
Dresden	9	58	630 or 475	90 or 145	C	150†	12	2200	Benz
	6	53	265 water or 450 foam	130	C	150†	12	800	Benz
Hamburg	14	..	525	150	C	...	..	...	...
London	1	..	720	...	C	120	..	800	Dennis
	94	..	500–700	...	..	90	..	800	...
Milan	1	..	525 or 265	90 or 180	C	52	..	1500	Ceirano
	10	..	525	90	C&P	34/55	..	...	I. F.
	2*	..	265	90	..	32	..	...	...
Munich	1	40	400	115	C	110	6	2300	Magirus
	8	..	400	115	..	...	..	...	...
Nuremberg	4	43	400	115	C	95†	..	...	Benz
Paris	28*	..	...	...	..	16	..	1000	Delahaye
	30	..	525	85	C	45/60	..	1800	...
	4	43	660	170	6P	115	4	1300	SOMUA
Shanghai	13*	..	250	...	..	30/40	4	...	Fiat
	3	..	300	...	..	40/45	4	...	Dennis
	7	..	500	...	..	48/60	4	...	Leyland
	1	..	500	...	..	72/110	8	...	Studebacker
	2	..	1000	...	..	85/90	6	...	Leyland
	1	..	1000	...	..	90/95	6	...	Merryweather
Vienna	14*	..	65	300	C	20	..	1300	...
	24	..	160	300	C	35	..	1600	Rosenbauer
	19	..	250–320	225	C	80	..	...	...

*Booster wagons.
C—Centrifugal pump. P—Piston pump.
**Capacities correspond to pressures given in the next column.
†Diesel type motors. All others are gasoline.

Paris Fire Brigade.

Fig. 7. Booster wagon of the Paris Fire Brigade, with 80-gallon water tank, foam-air generator, 250 feet of 1½-inch hose on reel, and 650 feet of 2¾-inch hose on detachable reel. It carries a crew of five men.



Magirus Werke.

Fig. 8. Typical closed body pumping engine built by Magirus, Ulm, Germany, showing interior arrangement of equipment.

Among the new features of the 700-gallon pumping engine recently placed in service by the London fire brigade (Fig. 4), are a short wheel base adapted for narrow streets, a set of breathing apparatus for the entire crew, a 40-foot extension ladder, and a new design of hose body (Fig. 5), permitting laying of hose in a manner similar to the American practice, which heretofore was not used in foreign cities, except in Shanghai, China. The "dual purpose combination" pump and escape van of the London brigade (Fig. 6) provides reserve pumping capacity without additional automotive equipment, being carried on the escape vans equipped with 50 to 70 foot extension ladders on wheels, and a "first aid" water tank under pressure with hose reel. An interesting and very useful type of apparatus is the booster wagon of the Paris fire brigade (Fig. 7), which is housed in each station in addition to a combination

Daimler-Benz A. G.

Fig. 9. Standard German pumping engine with squad body built by Mercedes-Benz-Metz. It is Diesel powered and has a pumping capacity of 400 gallons per minute at 115 lbs. pressure. Note hose reels, seats for 11 men, and ample room for miscellaneous equipment.

Daimler-Benz A. G.

Fig. 10. Typical turnout of German fire station. Steel motor-raising 90-foot aerial and 400-gallon pumper with squad body, both powered with Diesel motors, and built by Mercedes-Benz-Metz, Germany.

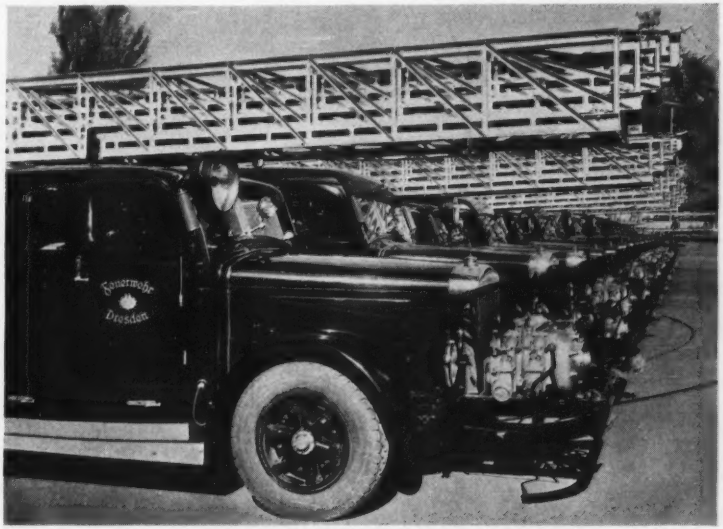
pump, hose and squad wagon and an aerial. This booster wagon carries an 80-gallon tank and pump, and is capable of quickly placing in operation a $1\frac{1}{2}$-inch line with spray nozzle, using water or foam-air as desired. About 90 per cent of all fires in Paris at which hose lines are placed in operation are extinguished by these booster wagons.

The latest designs of German fire apparatus, built by Daimler-Benz, and by Magirus, and found in service in fire departments all over the world, are shown in Figs. 8, 9, and 10. Their essential features are Diesel motors, squad bodies for equipment and men, and arrangement of the pumping units at the rear, or at the front end of the chassis. A typical turnout of a German fire station is pictured in Fig. 10. The personnel consists of 17 men, including the station officer, and 3000 feet of hose is carried. It is interesting to note that during the past year (1935), several large city fire departments in Germany have purchased a complete set of new motor apparatus for all their stations,

either with the aid of annual allotments set aside for several years in the budget, or with loans from state or insurance institutions. The apparatus purchased last year by the Dresden fire department, shown in Fig. 11, consists of 9 pumps, hose and squad pieces, 6 aerials with pumps, and 3 combination hose and searchlight wagons. This forms an outstanding example of standardization considered beneficial from the standpoint of economy and efficiency.

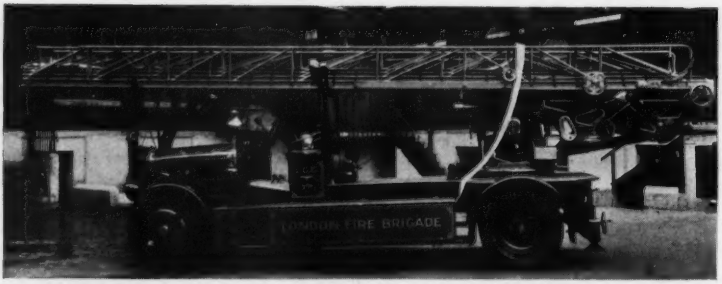
A rather unusual method of determining the required rated capacity of pumping engines has been followed by the Vienna fire department. In adopting a rated capacity of 160 gallons per minute at 300 lbs. pump pressure for their pumps, they have reasoned that in order to effect extinguishment of an average floor area of 100 sq. meters (1089 sq. ft.), a pumping capacity of 160 gallons is required, using 3/5 inch nozzle at 225 lbs. pressure; hence, a rough estimate of the area involved by fire determines the number of pumps to be brought into action.

Table V lists the various types of aerials used by foreign fire departments. In all cities outside of North America for which information has been available to the writer, all aerials placed in service during the past ten years have been manufactured by the firms of Magirus or Metz in Germany, mounted sometimes on chassis of local manufacture. The essential features of those aerials



Dresden Fire Department.

Fig. 11. Eighteen pieces of apparatus purchased in 1935 by Dresden, Germany, from Daimler-Benz A. G., Gaggenan. All are standard chassis with 150 horse power, 12-cylinder, Diesel motors. There are nine pumpers, six 100-foot automatic aerials with combination water and foam-air pumps, and three combination hose and squad wagons.



London Fire Brigade.

Fig. 12. A 100-foot steel, Morris-Magirus aerial mounted on a Dennis chassis of English manufacture for the London Fire Brigade. The aerial is in four sections, fully automatic, one man operated by multiple clutch from driving motor, automatic safety devices to prevent overloading, rapid action jacks, loud speaker, and tower nozzle with platform for operator.

Table V. Automatic Aerials in Foreign Fire Departments.

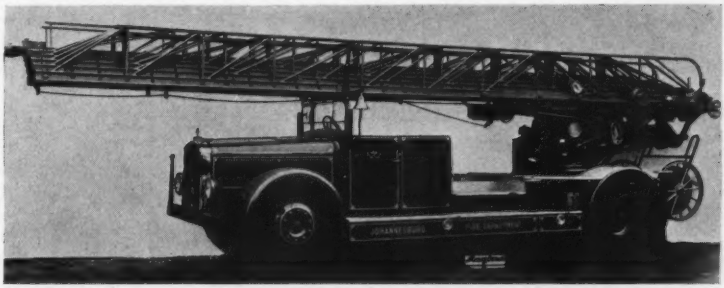
City	No.	Ladder			Motor		Make
		Height Feet	Sections	Material	H.P.	Cyl.	
Dresden	6	100	4	Steel	150*	12	Metz-Benz
Hamburg	1	100	4	Steel	100	6	Magirus
	9	85–100	4	Wood	...	..	...
London	6	100	4	Steel	...	..	Morris-Magirus-Dennis
	7	92	4	Wood	...	..	...
Milan	1	85	4	Wood	65	..	Magirus
	1	125	5	Steel	60	..	Magirus-Fiat
Paris	6	100	4	Wood	...	..	Magirus-Delahaye
Shanghai	1	85	4	Wood	45	4	Magirus-Morris
	1	100	4	...	40	4	Magirus-Delahaye
	1	100	4	...	70	4	Merced.-Daim.
	1	150	6	Steel	110	6	Magirus
Vienna	5†	100	4	...	...	..	Magirus

*Diesel type motors, all others are gasoline.
†Vienna has 7 other automatic aerials, details of which are not known.

are their height from 85 to 150 feet; limited overall length from 28 to 35 feet; rigid construction of steel trussed ladder in 4 to 6 sections; one man control of all motions of raising, turning and extending, which may be performed simultaneously in 14 to 35 seconds by means of a multiple clutch system powered from the driving motor, with safety devices designed to prevent overloading of the ladder, and to compensate for tilting sideways on uneven ground. A modern Morris-Magirus 100-foot steel aerial of the London fire brigade is shown in Fig. 12; Fig. 13 pictures a six-sectional Magirus 150-foot aerial, and Fig. 14 a Mercedes-Benz-Metz 90-foot steel aerial of latest design.

An important development in fire fighting equipment in Europe is the extensive use of the recently invented "foam-air" or mechanical foam.* Its

*Entwicklung und Augenblicklicher Stand des Luftschaum Löschverfahrens, by Müller. "Feuerschutz," No. 12, Dec., 1935.



Magirus Werke.

Fig. 13. A 150-foot steel motor-raising aerial of latest design. Built by Magirus Werke (Germany), in six sections with trussed ladders, fully automatic, and one man operated.

Daimler-Benz A. G.

Fig. 14. A standard German aerial built by Mercedes-Benz-Metz. Aerial consists of four steel sections, one man operated, fully automatic, motor (Diesel) driven. Note the rapid-action jacks, hose reel, and closed compartment for the men.

low cost and effectiveness on flammable liquids have resulted in its adoption by many foreign fire departments which are now equipped with foam-air pumps and generator nozzles, and carry tanks of patent soap solution, which, when introduced into a water line with a proper proportion of air, produces mechanical foam. Due to the neutral quality of mechanical foam, it is being recommended for use on ordinary house fires, but has so far not found wide application in that field. A combination water and mechanical foam pump mounted on an aerial truck in Dresden is shown in Fig. 15.

It is beyond the scope of this article to describe in detail all foreign fire apparatus; however, brief mention should be made here of the use of trailers in European fire departments for carrying various auxiliary equipment generally not assigned to first alarms. These carry small motor pumps, smoke

Table VI. Hose and Hydrants Used by Foreign Fire Departments.

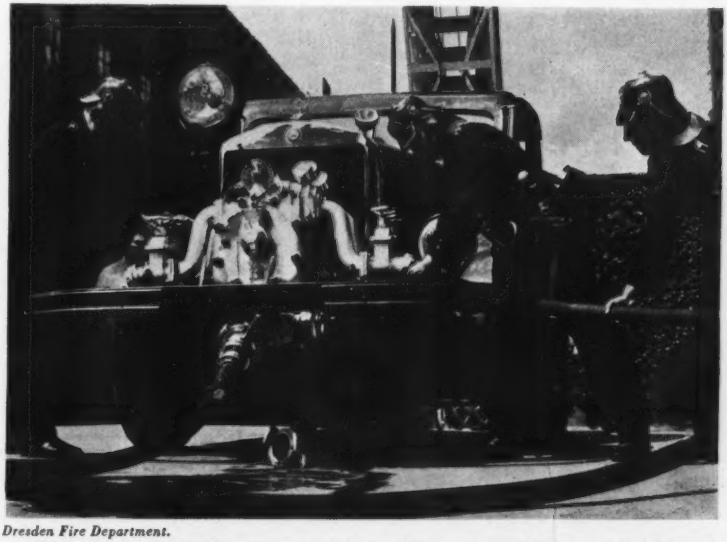
City	Total Feet	Size Inches	How Carried on Apparatus	Manner in Which Hose Is Used	Nozzle Tips Inches	Hydrants Number	Hydrants Type
Amsterdam ...	16700	1¾	....	....	...	6025	Underground
	62100	2½	....	....	...	3082	Post
	5700	3¾	....	....	...	...	...
Berlin	....	1¾	Reels	Extension on 3″	...	...	...
	....	3	Reels	Long line and leads to pumps from hydrants	...	...	...
Birmingham ..	....	2¾	Coiled, 75′	Standard and leads to pumps from hydrants	⅞, 1, and small	...	...
Copenhagen ..	8150	1¾	Reels	Extension	...	2872	"Copenhagen"
	42500	2½	Reels	Standard	...	434	Post
	7400	4	....	....	...	...	...
Dresden	55500	2	Reels	Standard and extension on 3″	¼, ½, ¾	...	...
	18000	3	Reels and Coils	Leads to pumps from hydrants and long lay	1, 1¼	...	...
Düsseldorf ...	35400	2	Reels	Same as in Dresden	⅜, ½	5211	Underground
	30600	3	Reels and Coils	Same as in Dresden	...	487	Post
Hamburg	184000	2	Reels	Same as in Dresden	...	...	...
	....	3.3	Reels and Coils	Same as in Dresden	...	...	...
London	300000	2¾	Hose box	Standard	...	30952	Underground
	....	3½	....	Fireboats	...	...	...
Milan	25000	1.6	Coiled	....	...	...	Underground
	46800	2¾	Coiled	....	...	...	...
	3400	4	....	....	...	...	...
Moscow	....	1¾	Reels	Extension on 2½″	½	...	Underground
	....	2½	Reels	Standard	¾, 1	...	...
Paris	48500	1½	Reels and Coils	Extension on 2¾″	½	8989	Underground
	152000	2¾	Reels	Standard	¾	...	...
	...	4⅓	Wagon Bed	Long lays—hand line	1¼	...	...
				Long lays—turret	1½–1⅞	...	...
Shanghai	....	1½	Reels	Extension on 2½″	...	...	...
	....	2½	Reels, Bed, Coils	Extension on 3½″	...	...	...
	....	3½	Wagon Bed	Street lays	...	...	...
Vienna	316000	2	Reels and Coils	All purpose; 2 lines siamesed for long lays	...	8427	...

NOTE: Snap couplings are in general use by foreign fire departments on all sizes of hose.

ventilators, CO_2 batteries, searchlight equipment, wrecking trucks, etc. A modern squad wagon, with trailer attached, built by Magirus for the city of Munich is shown in Fig. 16.

Fire Hose and Hydrants.

A record of fire hose used by various representative fire departments in foreign countries is presented in Table VI. In comparison with the American practice it will be noted that small nozzle tips are used in conjunction with relatively large hose diameters, permitting lower engine pressures, and smaller pump capacities, as noted in Table IV. The principal reason for this is that with the prevailing type of building construction heavy streams are seldom required, and fires of greater extent are fought with more streams rather than heavy streams. An added reason for such a procedure is the comparatively limited hydrant capacity in the majority of cities, except where new post hydrants of 6-inch or larger diameter are available as in some German cities. The practice of supplying pumpers stationed near the fire through hose lines from one or more hydrants is not infrequent — an additional reason for such a practice being the construction of most pumpers as combination squad units, resulting in the desirability of keeping the apparatus near the fire. Indexed hydrant books showing location of hydrants and sizes of water mains are carried on the apparatus to assist the personnel in providing adequate water



Dresden Fire Department.

Fig. 15. A combination water and foam-air pump mounted on an aerial truck of the Dresden Fire Department. The foam capacity is 450 gallons per minute, simultaneously with 300 gallons per minute of water.

Magirus Werke.

Fig. 16. A typical German rescue wagon with trailer attached, built by Magirus for the city of Munich.

supply for the pumpers in action at a fire. A typical German post hydrant is shown in Fig. 17, with a pumper of the Düsseldorf fire department taking suction from it, and supplying several streams characteristic of the nozzles and hose layouts used.

Hose used by foreign fire departments is considerably lighter than that employed in American cities, having only a single jacket and the usual rubber lining. The best hose is employed in Germany, where it is made of "Rami," a very rigid fabric capable of withstanding pressures up to 900 lbs. (60 atmospheres) during acceptance tests. Exceptional care is exercised in keeping hose in proper condition; every section is given a pressure test after use and minor defects are immediately repaired. A complete up-to-date record is kept of every section, showing how it was used and repairs made. General practice is to concentrate the entire supply of spare hose at "hose centers" for a group of fire stations where hose is cared for and delivered by special hose wagons to the fire companies operating at the fire. A fresh supply is loaded on the fire apparatus at the fire ground, and wet hose is returned directly to the hose center.* In this manner it is claimed that the amount of work performed by each section of hose is equalized, and the average life of hose is prolonged up to ten years.

Maintenance and Technical Work.

The great majority of fire departments in foreign cities with a population over 200,000 are now operating on the basis of 24 hours duty followed by 24 hours off duty. Exception to this general rule is found in France, where fire departments are a part of the military establishment, with a large portion

*Interchangeable hose reels used by some departments facilitate this operation.

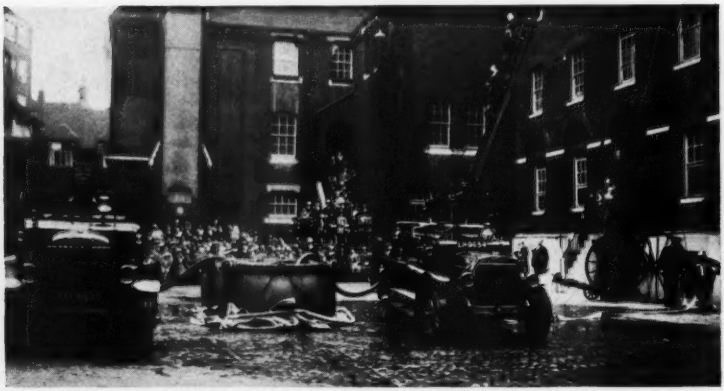
of the personnel secured by military draft, and also in some British cities, where a modified shift system is used in conjunction with accommodations for the entire personnel and their families at fire station sites. During time on duty the fire personnel in Germany, in the Scandinavian countries, and to a certain extent in other European countries is required to perform a variable amount of repair and improvement work at the stations — for which proper facilities are provided. Major repairs and specialized work, however, are done at the main fire department shops by specialists. Considerable stress is laid upon drills, to which time is devoted in most departments during five days of the week, and upon class instruction conducted at quarters by the supervising personnel.

Düsseldorf Fire Department.

Fig. 17. Pumper of the Düsseldorf Fire Department taking suction from a post hydrant and supplying four streams with 4½-inch nozzles and six streams with ⅜-inch nozzles, delivering water at 60 pounds pump pressure. Capacity of the hydrant is 1600 gallons per minute.

In the Hamburg fire department, which is typical of the departments in northwestern Europe, the 24 hours on duty is so regulated that 8 hours (on the average) must be devoted daily, except Saturdays and Sundays, to actual fire duty, drills, instruction, fire prevention details, and repair and improvement work at the shops. This 8-hour period begins at 8:30 in the morning, and ends at 5:30 in the afternoon, with an interruption from noon until 2:00 P.M. Fire duty during the rest of the day completes the 8-hour work period.

All the chief officers in German cities perform a large amount of technical work, according to a specified daily schedule, on matters relating to: examination and rendering of opinion on building and installation plans, conduct of tests and preparation of reports thereon, preparation and examination of designs of new equipment and apparatus, and similar subjects. The work is apportioned among those officers in accordance with their qualifications as graduate engineers. Chief officers do not work on the 24-hour basis, as the rest of the fire force do, but devote one day out of each three to technical work exclusively, one day to fire and supervisory duties, and one day they are free from all duty except special calls to large fires or other emergencies. The duties of the chief officers in England, Italy, Austria and other European countries are essentially the same, although the distribution of their working time may in each case be differently regulated.



London Fire Brigade.

Fig. 18. Every Wednesday afternoon this drill in which probationary firemen exhibit their skill takes place at the London fire headquarters. Note the grandstand for the public.

The relationship between the total fire department personnel in different cities and the number of men on fire duty daily is shown in Table VII, from which it is seen that from 35 to 43 per cent of the total personnel is available for fire duty.

Table VII. Distribution of Fire Department Personnel.

City	Alternation of Platoons (Hours)	Total Personnel	Personnel Performing Fire Duty Daily	
			Number of Men on Duty*	Per Cent of Total Personnel
Copenhagen	24–24	408	144	35
Hamburg	24–24	675	271	39
London	2 Platoon	2105	770	36
Milan	24–24	323	134	41
Paris	Military Assignment	1786	635	35
Vienna	24–24	1019	441	43

*Including Chief Officers.

Drills and Training.

Drills and training of the fire department personnel are receiving much attention in all foreign cities, and in their daily schedules most departments devote a specified time to both.

In London, instruction begins with a probationary period of three months for recruits, during which time they go through intensive training at headquarters. Thereafter, they are assigned to permanent positions at the various stations of the brigade. An interesting feature of the London instruction system is the weekly drill conducted at headquarters in the presence of the general public, for whom grandstand seats are provided (Fig. 18). A printed program

of the drill is distributed to all those present, which incorporates some sound fire prevention advice, and brief statistical data about the brigade. Explanations of the evolutions are given by an officer. Probationary firemen and five alternate units from different stations participate in the drill, and it is concluded by a mimic alarm and turnout of the headquarters station. The entire procedure is a splendid display of skill, precision and speed, unsurpassed by any of the 35 fire departments studied by the writer at various times in different parts of the world. It no doubt creates a feeling of confidence in the efficiency of the fire service among the public, and is an example worth following almost anywhere as a matter of sound publicity.

Paris Fire Brigade.

Fig. 19. Companies of the Paris Fire Brigade performing evolutions at one of the new district stations. Note the large size of the station building—this is typical of half the stations in Paris.

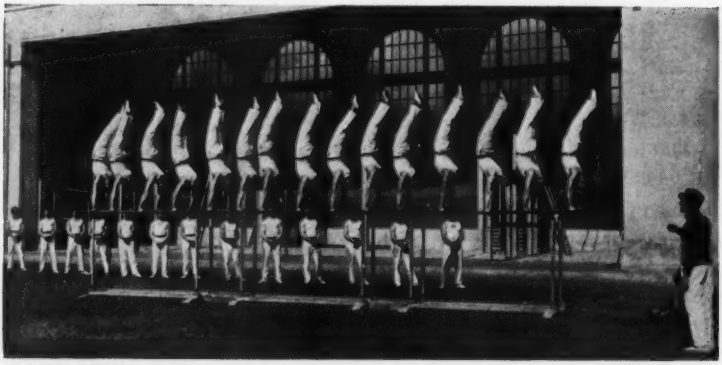
Notable features of training in the Paris fire brigade are drill tower evolutions (Fig. 19), gymnasium work (Fig. 20), and class instruction conducted with the aid of two well-edited and illustrated instruction books comprising about 700 pages* and available to the men in the service. Constant instruction is essential because a large proportion of the personnel is secured by military draft. It is carried on daily at each of the 12 company headquarter stations, where large drill yards and towers are available, and from which the remaining 12 fire stations are manned by detail.

Training in German cities, as well as in most of the other European cities, is conducted at fire stations which are equipped with the necessary facilities. If not interrupted by fire duty, drills are conducted daily (except Saturdays and Sundays) for brief periods of three-quarters to one hour under supervision of station officers. In addition, about one hour is devoted to class instruction in which ranking officers or specialists take part. Much stress is laid upon test and preliminary instruction pertaining to equipment or methods about to be introduced.

The Association of German Fire Engineers** contributes materially to the standardization of methods and training through its scientific work and

*"Règlements, Ecole du Sapeur Pompier" and "Instruction sur les Constructions et le Service des Eaux à Paris."

**"Reichsverein Deutscher Feuerwehr Ingenieure."



Paris Fire Brigade.

Fig. 20. Athletic exercises of Paris firemen during daily drills at each of the department's 12 drill tower schools.

the participation of its members in the State Bureau of Fire Standards. The influence of the Association is augmented through a plan whereby it maintains an eligible list of candidates for chief officers whose qualifications as graduate engineers and competent fire officers are vouched for by the Association. Practically all of the ranking officers of all fire departments in Germany are appointed from that list after an intensive probationary training period of one year with four different fire departments in the country. A college diploma in engineering, high athletic standing, adaptability for the fire service, and character references are some of the prerequisites necessary before the name of a candidate can be placed on the eligible list. In this manner, a staff with diversified engineering and practical knowledge is secured for all fire departments in Germany.* The participation of this staff in various city and state planning commissions or bodies contributes materally to the prestige of the fire service.

An important feature of the training program of the Vienna fire department (the oldest full paid fire department in the world, dating back to 1685) is the school for petty officers, whose duties are comparable to those of company commanders in American cities. The course comprises a period of 10 months study in daily classes of 9 to 12 men. A final examination is held before a commission in which members from all ranks take part under the presidency of the Chief of the department. Those receiving a diploma are appointed as vacancies occur; however, should no vacancy be available within 6 years of service, all those completing the course receive a petty officer's salary. A minimum of 3 years of service in the department is required before enlistment in the school.

*The 29 ranking officers in Berlin, for example, are classified as follows: 9 mechanical engineers, 3 electrical engineers, 6 civil engineers, 4 architects, 3 chemists, and 4 not stated.

Fire Prevention.

Differences in organization of the agencies entrusted with fire prevention work and in the scope of their activities, depending in turn upon a wide variety of local conditions and laws, account for the lack of uniformity in the handling of fire prevention work in foreign cities. Therefore, only some of the more important practices common to most foreign cities will be mentioned below.

An important item in fire prevention work in foreign cities aiming to strike at the root of the problem, is the practice of examination and approval of plans for new building construction and alterations to existing buildings. Those plans are submitted to the fire department and examined by the chief officers with the purpose of making recommendations to insure fire safety. In addition, the majority of foreign cities require periodical licensing by the fire department of such buildings, processes, and storages that involve a special fire hazard to life or property, and make inspections of such properties at regular intervals. In Birmingham, England, for example, all places of public entertainment, hospitals, and certain business premises are licensed annually, periodically supervised by the fire brigade, and fire drills for attendants are held at definite intervals. In Milan, Italy, all establishments for manufacture, handling, and storage of combustible, flammable, and explosive substances are licensed by the fire department, and permits are issued for construction of garages, storage of flammables, and for all buildings in excess of 80 feet in height where standpipes and other fire protection equipment are required. A spot map of all inspections made during the year is included in the annual report of the Milan fire department, along with a spot map of fires, and helps in studying the relationship between the two. In Germany, all places of public assembly, storages, and hazardous manufacturing establishments of all kinds are grouped according to the degree of fire hazard they represent — this determines the frequency of inspections to which they are periodically subjected. Shanghai, China, regulates its principal fire hazards by the provisions of its building code, by licensing places of entertainment and the storage of hazardous goods, and by issuance of landing permits for hazardous goods. Particular attention is paid in most foreign cities to all public buildings, and permanent details of firemen are kept in some, such as in theatres over a certain seating capacity.

The nature of the fire prevention work carried on by the chief officers in Vienna and in German fire departments may be judged from the record contained in the Vienna fire department report for 1929, when 21 officers of that department contributed a total of 8038 hours of fire prevention work, having handled a total of 5189 cases, including participation in acceptance tests and inspections in conjunction with other supervisory offices, working out building specifications relating to fire safety, new ordinances, and the like.

Table VIII. Principal Causes of Fires in Foreign Cities.

Causes of Fires	City and Year: London 1933	Birmingham 1934	Berlin 1930	Paris 1934	Copenhagen 1934	Milan 1934	Hamburg 1934	Vienna 1929
Structural defect	337	..	108	139	61	28	35	333*
Lighting (Electricity)	260	..	..	..	57	..	..	..
Lighting (Gas)	59	28	..	..	25	1	4	..
Lighting (Oil)	145	8	..	..	22	..	46	..
Electrical installation (short circuit)	..	124	345	408	..	42	65	..
Heating	697	165	..	..	11	36	109	..
In course of business or industry	1505	..	66	..	183	..	46	..
Carelessness	1810	526	1544	1252	230	100	184	586
Unknown	225	178	1107	387	184	121	262	236
Sparks from chimney	..	179	..	..	..	3	90	44
Engine backfire	..	56	..	302	..	..	55	..
Other causes	..	95	538	428	79	1	83	415
Spontaneous ignition	..	12	214	..	..	17	32	11
Explosion	..	..	29	..	..	..	40	12
Incendiary	..	..	73	..	..	3	6	11
Flammables too near fire	..	53	..	..	..	..	..	..
Accidental	..	..	..	..	..	92	..	..
Total (other than Chimney Fires)	5038	1424	4024	2916	852	444	1056	1648
Chimney Fires	839	344	..	3959	40	102	263	..

*Includes lighting and heating.

Another step toward reduction of fire hazards is illustrated by the provisions of the London Building Act limiting the cubic content of all buildings used for trade or manufacture to 250,000 cubic feet, and their floor area to 40,000 square feet, and providing for party walls with parapets, and height limit of 80 feet. The latter has, however, been allowed up to 110 feet — subject to certain requirements set forth by the chief officer of the fire brigade. Warehouse, manufacturing, garage, department store, and some other buildings exceeding 150,000 cubic feet content, are subject to a series of regulations regarding fire-resistive construction.

The general use of masonry or concrete for building construction, noncombustible roof coverings, height limits, and division walls result in the limitation of fire areas in the majority of foreign cities, as compared with American cities. Those conditions coincident with the application of the principle of personal liability of the tenants and owners for fires caused by their negligence seem to have a very favorable effect upon the annual per capita frequency of fires in foreign cities, which averages 1.09 per 1000 population as against 6.16 in a group of large American cities* and 6.76 in all American cities over 20,000 population.** In spite of less fire prevention supervision of housekeeping conditions in foreign cities as compared with American cities, the record of fire losses and frequency of fires show that fire prevention work in foreign cities, aimed principally at the elimination of construction favorable

*N.F.P.A. Quarterly, Vol. 29, No. 3, p. 205.

**National Board of Fire Underwriters, Report of the Committee on Statistics and Origin of Fires, May, 1936.

to the rapid spread of fire and regulation of hazardous properties by licensing and inspection, is eminently successful in controlling the total fire waste.

A classification of fire causes in foreign cities is presented in Table VIII. Differences in the methods of classification of causes by different cities make an accurate comparison impossible, but the causes as listed in the table are nevertheless of considerable interest. Carelessness of all types, heating, lighting, and unknown causes figure prominently in the tabulation, whereas structural defects seem to account for relatively fewer fires.

A classification of fires by occupancy, shown in Table IX, suggests that there are few fires in public buildings, theatres, garages, and warehouses which are subject to most rigid regulation. Chimney fires are few where chimney cleaning is a regular procedure under fire department supervision as in Vienna and Munich, and excessively numerous where unsupervised as in Paris. The percentage of residential fires to total number of fires is similar to that in American cities, but is considerably less in foreign cities when fires in buildings only are used for comparison.

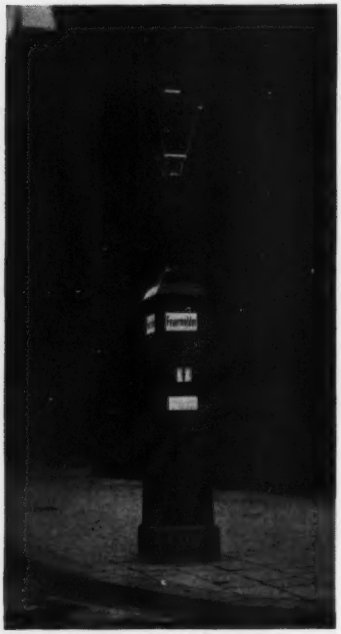
Table IX. Classification of Fires According to Occupancy.

Nature of Occupancy	City and Year: Düsseldorf 1930	Hamburg 1934	Vienna 1929	Birmingham 1934	Paris 1934	Milan 1934	Stockholm 1933
Public Buildings	9	8	46	17	9	8	3
Theatres, Amusement Halls	6	5	5	14	30	13	4
Residential Buildings	105	456	857	429	1408	113	615
Mercantile	13	63	115	82	70	30	80
Works, Shops	45	77	243	206	260	84	56
Warehouses, Storages	14	23	36	50	91	33	11
Garages	..	8	5	40	43	3	26
Miscellaneous	9	81	60	141	158*	33	74*
Outside Buildings	70	203	103	328	86	24	146
Automobiles	40	103	164	107	375	39	79
Office Buildings	3	29	14	10	25	..	..
Basements**	43	..	..	..	361	64	62
Total (other than Chimney Fires)	357	1056	1648	1424	2916	444	1156
Chimney Fires	59	263	..	344	3959	102	47***
Grand Total	416	1319	1648	1768	6875	546	1156****

*Includes 29 false alarms.
**Includes residential and mercantile building basements.
***Included in above total.
****Includes 409 to which fire department was not called.

Fire Alarm Systems.

As detailed description of fire alarm systems in foreign cities is beyond the scope of this article, only some features of those systems will be mentioned which distinguish them from American standards. In conformity with the principle that each fire station assures the protection of a given area, box alarms are carried directly to the stations due to respond to the respective locations. Alarms are then manually or automatically relayed or telephoned to the central fire alarm office. This necessitates an attendant remaining on



Düsseldorf Fire Department.

Fig. 21. Typical German fire alarm box, with street identification light over the post.

duty at each fire station after the apparatus has left. An exception to this practice is found in Amsterdam, which maintains a combination box-telephone system operated through a central terminal at the city telephone exchange with a central recording office at fire department headquarters. With this system operators at fire stations are not required. The central fire alarm office at the Vienna headquarters is equipped with a control board showing at a glance the distribution of all fire apparatus in the city by means of varicolored lights. New fire alarm boxes installed during the past ten years include identification red lights, a telephone receiver permitting direct conversation between person transmitting alarm and the fire alarm office, and gongs or sirens for apprehension of persons transmitting false alarms. Some cities have installed signs on buildings or street corners giving the nearest box location. Fig. 21 shows a typical German fire alarm box.

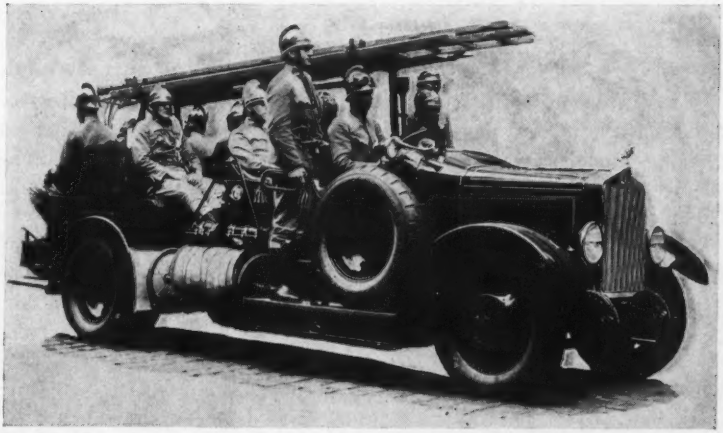
The accessibility of fire alarm boxes varies in different cities, and box alarms are few in some cities. In Table X, the data on Hamburg are representative of the average proportion of box alarms to other alarms received in most European cities. Figures on London and Amsterdam have been selected as representative of particularly extensive use of the fire alarm system.

Table X. Manner in Which Alarms Were Received.

Year	City	Box	Telephone	Verbal	Others	Total
1934	Hamburg:					
	Alarms for Fire.....	296	960	247	235	1738
	Other Calls	81	1326	426	380	2213
1934	Amsterdam	2454	1016	335	...	3805
1933	London	4007	4173	1081	130	9391

Noteworthy features of fire alarm receiving apparatus at the fire stations are lighted boards on which street address of fire is flashed, loud speakers, and signal boards showing which apparatus is to respond each time. Teletype transmission of alarms is in effect in some cities on the European continent.

Radio is rapidly becoming of importance in the foreign fire service. Vienna and other European cities have their stations equipped with receiving



Vienna Fire Department.

Fig. 22. A squad wagon of the Vienna Fire Department carrying 10 men, hose, radio receiving and sending set, and miscellaneous equipment. One wagon of this kind responds to every fire from one of the seven district super-stations.

and sending sets. Chiefs' cars are radio equipped in many cities. All squad wagons in Vienna (Fig. 22), one of which responds to every fire, carry receiving and sending radio units. Loud speaker equipment is carried to fires in some German cities, and is used there to issue orders.

Summary and Conclusion.

Summarizing the practice in foreign fire departments, recognition must first be given the development of new types of fire apparatus embodying a variety of improvements and thoroughly modern designs of aerials, pumps, and auxiliary units. This modernization has not only improved the fire fighting qualities of the apparatus, but has resulted in economies in maintenance. In spite of financial stringency of recent times throughout the world, several foreign cities, like Dresden, have pioneered in renovation of the entire fire department apparatus to meet new demands imposed by changing physical conditions in cities. This experience should be of particular interest to all American cities which are faced with a much greater potential hazard of rapid spread of fires, and which have neglected replacement of obsolete fire apparatus for several years. The emphasis of foreign fire departments upon proper training of personnel is a natural sequel to changing conditions in cities with respect to new hazards, traffic, and modernization of fire apparatus. This has for some time been fully recognized by American fire chiefs, and it devolves upon the city administrations to appreciate the necessity of giving that problem all the attention and financial support it merits, as is being done in foreign cities.

Legislation Against Fireworks.

The disgraceful record of deaths, injuries and fires due to the indiscriminate use of fireworks as described in the article, "Fireworks Casualties and Regulation," published in the April, 1936, QUARTERLY (page 300), caused widespread interest and many inquiries as to the extent to which existing legislation controls this wholly unnecessary hazard.

A survey made by the N.F.P.A. Executive Office during the past summer shows that substantial progress has been made in the enactment of fireworks legislation since the last similar survey made by the Association in 1925 (QUARTERLY, April, 1925, page 350). Despite the steady growth of public opinion against the use of fireworks, this hazard continues to cause a large number of deaths and injuries and a property loss estimated at nearly $1,000,000 a year. Existing legislation must be greatly extended before this hazard can be eliminated. Incomplete reports of the 1936 Independence Day period indicate that fires and casualties continued at substantially the same level as in the previous year for which figures were reported in the April QUARTERLY.

The N.F.P.A. has long advocated the complete prohibition of the public sale and use of fireworks of any kind on the ground that complete prohibition, supported by public opinion, is the only way to keep fireworks out of the hands of children and irresponsible persons. Provision is made in the N.F.P.A. model ordinance for public displays of fireworks by responsible persons under supervision of fire department or other city officials and for necessary special uses such as railroad signaling.

The present survey shows that 23 states have now passed laws controlling fireworks to varying degrees. These are:

Arkansas	Massachusetts	Pennsylvania
Connecticut	Michigan	Rhode Island
Illinois	Minnesota	South Carolina
Indiana	Nebraska	South Dakota
Kansas	New Jersey	Tennessee
Kentucky	North Dakota	Vermont
Louisiana	Ohio	Wisconsin
Maine	Oregon	

This compares with only a dozen states which had regulations of any kind in 1925. Any sort of control of fireworks helps to reduce the hazard, but much of the state legislation is fundamentally ineffective as it operates only to limit the size or type of fireworks. Sad experience shows that fires can be started just as readily by a firecracker two inches long as by one of larger size and that children are burned to death when their clothing is ignited by "harmless" sparklers just as it may be in the case of larger fireworks.

In several states the laws are detailed and complete as to scope and method of enforcement. In others brief restrictions are confined to a ban on the more dangerous types of fireworks most apt to poison or maim the users. Two states, Michigan and Kentucky, have conformed to requirements recommended by the N.F.P.A. and prohibit sale and use of all fireworks, except for properly supervised public displays.

State-wide and possibly federal legislation against fireworks is necessary for complete control. Although the present extent of state laws is still far from adequate, the steadily increasing adoption of them is encouraging for ultimate elimination of this serious hazard.

City Ordinances.

Enforcement of city fireworks ordinances has frequently given much trouble in the absence of state legislation. "Bootleg" dealers can sell outside the city limits with impunity. Experience has nevertheless demonstrated the value of the city ordinance in curtailing the number of casualties and property damage from this hazard. General adoption of such ordinances in any state also influences the ultimate acceptance of proper state statutes.

A decade ago there were relatively few municipalities which had adequate ordinances for control of fireworks and those places were for the most part the larger cities. Results of the present survey of the United States show a surprising increase of fireworks ordinances adopted in communities of all sizes during recent years. While the tabulation is far from exhaustive, 553 cities and towns in thirty-five states are now on record as having some sort of ordinance regulating fireworks. Three hundred and eighty of them prohibit the sale or use of fireworks except for special public displays. This latter group includes 42 of the 93 cities of the country over 100,000 population. Following is a list of the 380 cities and towns with prohibitory ordinances. Contributions of data useful in correcting or adding to this summary from QUARTERLY readers will be welcomed.

Alabama (2)
Birmingham
Montgomery

Arizona (3)
Bisbee
Phoenix
Yuma

Arkansas (1)
Fort Smith

California (13)
Alhambra
Bakersfield
Berkeley
Fresno
Glendale
Huntington Park

California, Cont.
Long Beach
Oakland
Pasadena
Sacramento
San Bernardino
San Francisco
San Jose

Connecticut (3)
Bridgeport
Hartford
New Britain

Delaware (1)
Wilmington

Dist. of Columbia (1)
Washington

Florida (2)
Jacksonville
Miami

Georgia (2)
Augusta
Macon

Idaho (1)
Pocatello

Illinois (7)
Berwyn
Chicago
Chicago Heights
Niles
Rock Island
Urbana
Winnetka

Indiana (3)
Logansport
Muncie
Richmond

Iowa (66)
Albia
Anamosa
Atlantic
Audubon
Belle Plaine
Boone
Boyden
Brighton
Carroll
Centerville
Chariton
Charles City
Corwith
Dallas Center
Decorah
Farragut
Fayette
Fort Atkinson
Grundy Center
Hampton
Harlan
Humboldt
Iowa City
Kellogg
Keokuk
Kiron
Linden
Lowden
Madrid
Maquoketa
Mason City
Melborne
Melvern
Milford
Minden
Moville
Newell
Norwalk
Oelwein
Ottosen
Ottumwa
Panama
Panora
Pierson
Pilot Mound
Pleasantville
Pramghar
Rembrandt
Sanborn
Schaller
Sheldon
Shenandoah
Sioux City
Spencer
Spillville
St. Ansgar
State Center

Iowa, Cont.
Storm Lake
Swea City
Unionville
Ute
Villisca
Vinton
Waterloo
Winfield
Wyoming

Kansas (1)
Topeka

Kentucky (3)
Lexington
Newport
Owensboro

Louisiana (17)
Alexandria
Baton Rouge
Bunkie
Donaldsonville
Ferriday
Homer
Houma
Jeanerette
Jonesboro
Lafayette
Oak Grove
Pineville
Plain Dealing
Sulphur
Ville Platte
Vinton
White Castle

Maryland (2)
Baltimore
Hagerstown

Michigan (7)
Ann Arbor
Dearborn
Detroit
Highland Park
Kalamazoo
Pontiac
Port Huron

Minnesota (2)
Minneapolis
St. Paul

Mississippi (1)
Meridian

Missouri (1)
Kansas City

Montana (2)
Butte
Great Falls

Nebraska (2)
Lincoln
Omaha

Nevada (1)
Reno

New Jersey* (108)
Allentown
Alpine
Atlantic City
Audubon
Bayonne
Belleville
Beverly
Bloomfield
Bloomsbury
Bogota
Caldwell
Califon
Chatham
Clifton
Collingswood
Commercial Township
Cranford
Demarest
East Amwell
East Orange
East Paterson
Edgewater
Elizabeth
Ewing Township
Fair Lawn
Fort Lee
Greenwich Township
Guttenberg
Haddon Heights
Haledon
Hamilton Township
Hanover
Harrison
Harrison Township
Hawthorne
High Bridge
Hillside
Hoboken
Hopewell
Interlaken
Irvington
Jersey City
Kearny
Kenilworth
Lambertville
Lawrence Township
Lebanon
Linden
Little Ferry
Livingston
Lodi
Madison
Maplewood
Margate City
Midland Park

New Jersey, Cont.
Milford
Millburn
Millville
Montclair
Moonachie
Moorestown
Mount Holly
Newark
New Brunswick
New Providence Township
North Bergen
Northfield
North Plainfield
Ocean Township
Oldsman
Orange
Park Ridge
Passaic
Paterson
Paulsboro
Pennington
Penns Grove
Perth Amboy
Pitman
Point Pleasant
Pompton Lakes
Prospect Park
Raritan
Ridgefield
River Vale
Roseland
Roselle
Roselle Park
Sea Isle City
Secaucus
Somers Point
South Orange
Springfield Township
Summit
Trenton
Union City
Union Township
Ventnor
Verona
Vineland
Weehawken
West Caldwell
West New York
West Orange
West Paterson
Woodbridge
Woodbury
Woodbury Heights

New York (12)
Corning
Elmira
Fulton
Glens Falls
Jamestown
Mt. Vernon
Newburgh
New York City
Plattsburgh
Rochester
Saratoga Springs
Syracuse

North Carolina (6)
Asheville
Greensboro
High Point
Raleigh
Wilmington
Winston-Salem

Ohio (19)
Akron
Alliance
Ashtabula
Cincinnati
Cleveland
Cleveland Heights
Columbus
E. Liverpool
Hamilton
Lakewood
Lorain
Marion
Middletown
Newark
Portsmouth
Sandusky
Steubenville
Youngstown
Zanesville

Oklahoma (1)
Shawnee

Oregon (1)
Portland

Pennsylvania (8)
Altoona
Chester
Harrisburg
Johnstown
Philadelphia
Pottsville
Reading
Upper Darby

South Carolina (2)
Columbia
Spartanburg

South Dakota (1)
Sioux Falls

Tennessee (1)
Knoxville

Texas (6)
Abilene
Beaumont
Dallas
Fort Worth
Galveston
Waco

Utah (12)
Brigham City
Cedar City
Lehi
Logan
Ogden
Park City
Price
Provo
Richfield
Salt Lake City
Spanish Fork
Tooele

Virginia (47)
Amherst
Altavista
Chase City
Chincoteague
Christianburg
Claremont
Coeburn
Colonial Beach
Colonial Heights
Courtland
Danville
Dublin
Emporia
Farmville
Franklin
Front Royal
Hampton
Lexington
Lynchburg
Marion
Middleburg
Mt. Crawford
Newport News
Norfolk
Norton

*Municipalities in New Jersey which reported to the State Department of Labor as prohibiting fireworks. In some instances little or no attempt is made to enforce the ordinance because of practical inability to prevent fireworks, which are purchased in adjoining municipalities without similar legal restrictions, from being transported across boundaries located in closely built-up areas.

Virginia, Cont.
Onancook
Petersburg
Phoebus
Portsmouth
Pulaski
Richmond
Rural Retreat
Saltville
Shenandoah
Smithfield
St. Charles
St. Paul
Surry
Tappahannock
Timberville

Virginia, Cont.
Toms Brook
Virginia Beach
Urbana
Victoria
Williamsburg
Wythe
Woodstock

Washington (5)
Bellingham
Everett
Seattle
Tacoma
Yakima

West Virginia (5)
Charleston
Clarksburg
Huntington
Parkersburg
Wheeling

Wisconsin (2)
Eau Claire
Milwaukee

A Home Dry Cleaning Explosion.

By John W. Leib,
Jackson, Mich.

The hazardous practice, all too common in American homes, of using household type electric washing machines for home dry cleaning resulted fatally for a man and a woman in Jackson, Mich., when an explosion of gasoline vapor demolished a house on August 14, 1936. Two other occupants were injured.

The explosion occurred in the home of Mrs. Emma O'Donnell, 1215 Merriman Street, who was in the basement washing blankets and clothing in an electric washing machine which had been filled with twenty gallons of gasoline. A roomer, Frank Van Horn, was also in the basement assisting Mrs. O'Donnell. Both were thrown to the floor, stunned by the blast, and were trapped by débris which clogged the stairway to the first floor. Both died later in a hospital after being assisted from the house by neighbors and firemen. Alice Van Horn, twenty-eight-year-old blind daughter of Frank, was in the living room on the first floor and was buried by falling débris and suffered from injuries and shock. Marian Miller, a sixteen-year-old girl, who had entered the house to assist Mrs. O'Donnell, was struck by a table moved by the blast, but managed to extricate herself and sounded an alarm from a public fire alarm box. Another woman hanging out clothes to dry in the back yard was uninjured.

Cause and Resulting Damage.

According to Fire Chief Ernest C. Daunter, the explosion was due to a blanket becoming wedged in the wringer of the washing machine, which caused a heavy load on the motor and resulted in a fuse blowing out. When changing the fuse, the knife switch was opened, but the motor was not disengaged. When the knife switch was again placed in position, an arc formed which

Courtesy Jackson Citizen Patriot.

Wreckage of the O'Donnell home in Jackson, Mich., resulting from the use of gasoline in an electric washing machine in the basement of the house. At the right on the ground may be seen the remains of the porch roof, while a portion of the second floor is shown close to the ground in the center of the picture.

ignited the vapor from the gasoline used in the machine. However, the explosion of vapor might have occurred from any electrical or mechanical spark, such as a sparking motor on the washing machine.

The force of the explosion was severe. The house appeared to have been twisted from the force of the blast coming from the basement. Although gasoline soaked the basement, fortunately no fire followed the first blast of flame; otherwise, the loss of life might have been greater. The basement floor was covered with gasoline soaked clothes and blankets. The ceiling of the basement was wrecked and both the first and second floors dropped, spilling furniture into the wreckage. The front porch was razed, leaving the cupola peak of the porch roof resting on the ground. Attached to the house was a grocery store operated by Mr. O'Donnell, husband of one of the victims. He reported being struck by merchandise thrown from the shelves by the force of the blast. Ammonia bottles were broken and fumes filled the store.

Advanced Courses in Firemen's Training.

By Horatio Bond, Engineer, N.F.P.A.

Over half of the U. S. cities over 20,000 population have a well-defined program of training in the fire department. One hundred and sixty have drill towers and have given every member of the department a basic course of instruction. In addition, state and regional fire schools have provided at least elementary instruction to a large number of firemen. Thirty thousand attended these schools, which numbered 350 in 1935.

Firemen attending these schools have a new appreciation of the importance of the fireman's job and increased confidence in their own abilities. This has brought about a vast improvement in morale, and the men are now clamoring for more and more advanced training courses.

The subjects most commonly covered by elementary drill tower instruction are the following:

- Knots and Ropes
- Hose Operations
- Ladder Operations
- Salvage Cover Work
- Practice with Tools for
  - (*a*) Forcible Entry
  - (*b*) Ventilation
  - (*c*) Overhauling
  - (*d*) Salvage
- Using and Recharging Extinguishers
- First Aid Practice
- Using Gas and Smoke Masks

Elementary training courses, particularly those included in firemen's short courses, often include such related courses of instruction as the following:

- Identification and Classification of Tools and Equipment
- Care, Selection and Testing of Hose
- Fire Fighting Principles
  - (*a*) Forcible Entry
  - (*b*) Ventilation
  - (*c*) Overhauling
  - (*d*) Salvage
- Hydraulics of Simple Hose Layouts
- Fire Extinguishers
- Principles of First Aid

At about the time, however, that basic courses covering the foregoing subjects are completed, those organizing firemen's training classes find themselves without published material for advanced courses and are hard put to it to keep a program going with substantial interest of participants.

The following suggestions may furnish a basis for advanced courses. They are equally suitable for regular firemen's training work in the individual fire department, or in short courses at state or regional schools, and may be useful until the bulk of published material available for the guidance of instructors becomes adequate to the demand.

Advanced Drill Tower Work.

Advanced work at the drill tower may include activities such as the following:

Practice in Operating Hydrants and Valves. How to inspect hydrants and valves to see that they are operating properly. Maintenance operations, greasing, painting, checking condition of couplings. Routine with hydrants and valves after fires. Checking to see if hydrant is frozen — thawing with steam hose.

Exhibit sectionalized hydrant where possible, typical of those in local use. Purpose of various parts. What happens when hydrant is opened and closed. How the hydrant drains itself. Shape of operating nut and wrenches. Direction of turn to open or close — are all alike in city?

Same routine with inside screw valves and outside screw and yoke valves. (The former are used in public water systems and the latter in pits or inside buildings on private water systems for fire protection.) Indicator posts on underground valves — direction of turn.

(See also related course of instruction on hydrants and valves.)

Pumpers and Drafting. The operation of pumpers (*a*) from hydrants with good hydrant pressures, (*b*) from hydrants with pressures less than 10 pounds per sq. in., and (*c*) from draft. Run a service test on the pumper, operating from draft as explained in "Fire Engine Tests and Fire Stream Tables" pamphlet of the National Board of Fire Underwriters, and on pages 1018-1028 of Crosby-Fiske-Forster Handbook of Fire Protection (8th edition). Determining pressures which operator must maintain at pumper to give proper pressure for varying lengths of lines and nozzle sizes.

Practice to enable each man to operate pump smoothly. Trouble shooting. Some suggestions are available on pp. 643-683 of "The Automobile Fire Apparatus Operator," by Robert H. McNeish (Los Angeles, 1925).

Advanced Related Courses.

Advanced courses on subjects related to drill tower and other training work may cover the following:

The Public Water System. Fire department classes should consider the water system of their own city; for short courses the water system of a typical city known to most of the group may be selected. A map of the system may be obtained from the water department or private utility or the stock company insurance rating bureau. Describe, covering source of water, treatment necessary, storage for pump supply, number and capacity of pumps, power supply, mains leading from pumping plant to center of city, secondary feeders and distributing mains, noting adequacy of sizes. Features of reliability, duplicate pumps or mains, storage reservoirs. Features of unreliability, droughts, floods, earthquakes, ice, forest fires, failures of power supply, lack of protection of pumping station. Pressures available in different parts of system.

Private Fire Protection Equipment. A course to describe the forms and functions of such items of private fire protection as automatic sprinklers, standpipes, private hydrants

and hose facilities, tanks, private fire pumps, alarm systems, supervisory systems, watchmen, private fire brigades, fire walls, fire doors, stair and elevator enclosures, protective equipment for special hazards (foam, CO_2, etc.).

Hydrants and Valves. Design of Hydrants. Proper installation. Frequency of inspection. Inspection routine. Same for valves. Valve pits, arrangement and construction. Spacing and location of hydrants in different parts of city. Different kinds of hydrants and valves. Purposes of valves on public water system; in private fire systems.

Pumpers and Drafting. Identification of the parts of a pumper. Types of pumps. Basic theory underlying pump operations. Meaning of such terms as atmospheric pressure, vacuum, back pressure, nozzle pressure. Calculating pump pressures for a variety of nozzle sizes and length of lines.

Elementary Science. A review course or an elementary course covering principles of physics and chemistry such as are usually covered in a high school course, but with special reference to the applications of these principles in the fire service: mechanics, heat phenomena, common elements, electricity, hydraulics. A text covering this ground is "Elementary Science Applied to the Fire Service" (166 pp. 1935, $1.00) by W. Fred Heisler of the Oklahoma State Department of Vocational Education. (Published by the College Book Store, Oklahoma A. & M. College, Stillwater, Okla.)

Hazardous Chemicals and Explosives. Identification of the principal characteristics and hazards of the commoner substances encountered in fire operations. These would include organic dusts, such as flour, sugar, coal; metallic dusts, such as aluminum and magnesium, pyroxylin plastics, photo film and other nitrocellulose products, chlorates, nitrates and peroxides; calcium carbide, camphor and naphthalene, sulphur and phosphorus. Liquids include the strong acids, nitric, sulphuric and hydrochloric, kerosene and other liquid fuels, alcohols, volatile solvents, such as gasoline, ether and carbon disulphide, paints, lacquers and cements, substances like linseed oil, fish oil and others which tend to ignite spontaneously, bromine (the vapor of which is toxic), also non-hazardous liquids such as carbon tetrachloride and chloroform, the vapors of which are anaesthetic. Gases include those which are toxic, suffocating or anaesthetic but non-flammable, such as chlorine, sulphur dioxide, carbon dioxide, nitrous oxide; those which are also flammable, such as ammonia, carbon monoxide, illuminating gas, bromine, hydrogen sulphide, hydrocyanic acid gas, ethylene, and ethyl chloride, and the other flammable gases such as acetylene, hydrogen, natural gas and liquid petroleum gases, butane and propane.

Members of classes may be required to prepare a list of these and other hazardous substances which are to be found in various buildings or in connection with industrial processes in their own communities. A detailed study can be made of any substances which are a predominating local hazard. A separate course might be made out of a study of gas and smoke masks, and air and oxygen helmets, to determine the degree of protection furnished against any gases likely to be encountered locally.

Laws and Regulations. Members of the class may be required to secure copies, read, study and discuss the following laws, ordinances and regulations pertaining to fire department work: the city charter, general state laws authorizing the organization of the fire department, city ordinances on the organization and operations of the fire department, fire department rules and regulations, any state fire marshal law or other state laws authorizing inspection work, investigation of fires or control of life hazards in buildings, state labor laws containing fire regulations, state and local building codes or fire prevention codes, including all local fire ordinances.

Making Fire Reports. Listing of the principal items to be covered in a report on a fire. Uses of reports (*a*) by officers to check up on work of their men at fires, (*b*) by chiefs to check up on performance of companies and apparatus, (*c*) to form basis for monthly and annual reports, (*d*) to bring out evidence of incendiarism, (*e*) to show cause and general circumstances of fire. How far can blanks be prepared to give the needed information? Can it all be given on one blank? To what extent are reports used as means of preventing another fire from the same set of circumstances?

Inspection Work. Make a list showing the number of buildings of each occupancy in the inspection district of each company. How to plan inspection. Kinds of inspections—small stores, sprinklered buildings and other target hazards. Special features of a dwelling house inspection campaign.

Mathematics. A review course covering mathematics used in hydraulic and other calculations or an elementary course. An excellent text prepared especially for fireman classes is Applied Arithmetic (Part I of "Mathematics Applied to the Fire Fighting Service," 78 pp., 1934, 60c, by W. Fred Heisler of the Oklahoma State Department of Vocational Education, obtainable from the College Book Store, Oklahoma A. & M. College, Stillwater, Oklahoma).

Case Work and Fire Problems.

A substantially unlimited number of class sessions can be held to work out or review specific problems. This is a most effective and practical phase of the training program, as it can be adapted to fit the needs of either new men or those of considerable experience and equally well to classes of privates or of officers.

Making Flow Tests. Use of Pilot Gauge. Measuring flow through orifices (nozzles), flow from a hydrant butt, flow tests from groups of hydrants to determine minimum supplies available for pumpers.

Making Fire Reports. Members of the class should be given an actual fire to report. They should write (*a*) a report such as the company officer would make regarding the run and the work done by his company, (*b*) the report an assistant deputy or district chief would write on the work of the entire department at the fire, and (*c*) the report which a headquarters investigator would make, giving data on loss, cause, etc.

Inspections. The members of the class will make actual inspections, record the data and bring their reports to class for discussion of (1) the procedure followed by the inspector, (2) the completeness of the report, (3) the soundness of any recommendations made or action taken. Inspections may cover such typical situations as those of (*a*) a dwelling, (*b*) a small store, (*c*) a single sprinklered building and (*d*) a typical "target" hazard. The latter is a general term descriptive of large buildings or groups of buildings, such as factory, institution, or large store, where there is a concentration of burnable value and where the arrangement of buildings and the presence of special hazards and private fire protection make the fire problem a relatively complicated one.

Grass Fires. Study of grass fires with respect to the relative humidity on days when they occur, the largest number per day. Average time of service of a fire company at a grass fire. Could patrols of districts where these fires occur be used to reduce runs? Special tools. Methods of handling grass fires.

Dump Fires and Fires in Rubbish and Dumps. Frequency. Special procedure. Protecting hose and men from injury. Water supply and watchmen at dumps. Ridding vacant lots of rubbish.

Fires in Dwellings and Small Stores. Attic, basement and partition fires. Application of principles of forcible entry, ventilation, salvage and overhaul.

Fire in a Single Sprinklered Building. It is suggested that a separate problem be made of a fire in a single sprinklered building before tackling a "target" hazard with a more complicated problem. This will enable the identification of the parts of a sprinkler system — street connection, control valve, alarm valve, piping arrangement, drips, fire department connection—and the establishment of a general procedure with such equipment. A useful supplementary text is "Use of Automatic Sprinkler Systems by Fire Departments" (12 pp., N.F.P.A., 10c).

Fire in a Specific "Target" Hazard. (Industrial Plant, Institution, Large Mercantile Lumber Yard, Bulk Oil Plant or other concentration of burnable value.) When given as the part of the training program this course may eventually cover every "target" hazard in the community. In a short course typical ones may be selected for discussion. Amount and relative combustibility of material stored. Arrangement of building with respect to spread of fire. Special occupancy hazards. Protective equipment (sprinklers, alarm systems, etc., protective equipment for special hazards). Coöperation of fire department with private fire brigade, if any. Plan of attack on fires involving certain assumed conditions typical of those most likely to occur.

In many cases the following procedure will be practical. One or more members of the class may be required to make an actual inspection of the building or property possible fires in which are to be studied. Reports may be brought back and criticized by the other members. This criticism should be for the purpose of showing the extent to which the reports cover features about which information is necessary to fire fighting operations. If data are inadequate a second inspection is made.

Assuming a fire typical of that which might occur in the building, the fire reports on the basis of which the actual fire operations can be discussed.

A similar procedure can be followed in the case of a building in which a fire has occurred. In such a case one or more members of the class may make fire reports on the basis of which the actual fire operations can be discussed.

As a general text, in addition to those mentioned above, the Crosby-Fiske-Forster Handbook of Fire Protection (Eighth edition, 1936, 1146 pp., N.F.P.A., $4.50) will be found useful. Detailed suggestions for many of the advanced courses outlined may be developed by consulting its index.

Gasoline Transport Truck Fires.

The long distance transportation of gasoline by so-called transport trucks has increased rapidly in recent years. Formerly long distance transportation of gasoline was largely by tank car or pipe line and these methods still account for the great bulk of the transportation, but gasoline tank trucks instead of being confined largely to use in short haul deliveries are now traveling long distances. This development is causing considerable concern to fire protection authorities in various parts of the country, particularly so because some irresponsible operators have gone into this business and the safeguards regularly followed by the major oil companies are often neglected.

State fire marshals and other fire protection authorities are concerned about the hazard and have been making inquiry of the N.F.P.A. as to the best method of handling it. The situation appears to be particularly acute in Kansas. The Kansas Inspection Bureau (Member N.F.P.A.) reports a large number of gasoline truck fires in the state during the past year. These fires in practically every case have involved trucks engaged in long distance transportation as distinguished from local deliveries.

On July 26, a gasoline transport tank truck overturned in the street of a residential section of Ottawa, Kansas. The spectacular fire which followed the spilling and igniting of the 2163 gallons of gasoline destroyed the truck and burned to death the driver and his woman companion who was riding with him in the cab. Burning gasoline flowed down the street for three blocks, ignited four dwellings and damaged them to the extent of about $20,000.

Three days later, the Board of City Commissioners passed an ordinance regulating the transportion of gasoline or any other flammable or explosive oil derivative into or through the city and providing a penalty for its violation. This ordinance follows:

> Section 1. It shall be unlawful for any person, firm or corporation to transport gasoline, naphtha, kerosene, distillate, oil, or other inflammable or explosive oil derivatives into or through the City of Ottawa, Kansas, by means of motor vehicle, motor truck or combination of motor truck and trailer or other vehicle, over and upon any of the streets, avenues or alleys of said City of Ottawa, Kansas, lying west of Lincoln Street and north of Fifteenth Street, provided, that this section shall not apply to or restrict the transportation of such commodities in railroad tank cars upon tracks maintained through said city or to the transportation of such commodities into or through said city in quantities of six hundred (600) gallons or less.
>
> Section 2. That any person, firm or corporation violating the terms of this ordinance shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in a sum not less than Five ($5.00) Dollars nor more than One Hundred ($100.00) Dollars.

Kansas Inspection Bureau.

The burning wreckage of the tank truck which overturned and caught fire in Ottawa, Kansas, July 26, 1936. The driver and a companion were burned to death. The houses at the right were ignited by the intense heat.

Section 3. That due to the menace to the public safety of life and property in said city, an emergency is hereby declared to exist and this ordinance shall take effect and be in force immediately upon its passage and publication.

This tragedy and property loss in Ottawa brought to a head a feeling among city and state officials and fire protection engineers throughout the state of Kansas that gasoline transport tank truck fires along the state highways were sufficiently frequent to justify regulation. Within a few days other Kansas cities and towns, including Newton, passed ordinances similar to that of Ottawa. The city of Chanute adopted an ordinance restricting the speed of large tank trucks to 10 miles per hour, and Iola prohibited tank trucks in the fire limits except for local deliveries.

Story of the Ottawa Tragedy.

The tank truck was owned by the Kaw Valley Oil Company of Topeka, and was returning home with a load of gasoline obtained from an oil refinery at Chanute. The accident occurred on the state highway which passes through the center of Ottawa. At 12:20 P.M., while traveling in the residential section, several blocks from the mercantile district, the truck swerved for some unknown reason, ran over the curb, and crashed into a steel street lamp post, breaking it into several pieces and pulling up its concrete setting. The impact knocked both front wheels loose from the chassis, but the truck continued down the street for about 100 feet, turned upside down, and immediately burst into flame. Neither of the two occupants of the truck cab had a chance to escape and their bodies were burned beyond identification.

When the fire department arrived, the burning gasoline was rapidly flowing down the street for three blocks, and several dwellings had ignited.

Kansas Inspection Bureau.

Burning gasoline flowed in the street for three blocks from the wrecked truck.

Apparently these buildings had become filled with gasoline vapor, and since the temperature was about 115° F. that day, they burned briskly. A pumper supplying two hose lines was connected to a hydrant at Ninth Street, and two other lines were connected to a hydrant at Seventh Street. Four lines were all the small mains in this part of town would supply. The firemen concentrated their efforts on the dwelling fires and did an excellent job of confining the fire to four dwellings. It was two hours before the fire was brought under control, and five hours before the firemen returned to quarters.

The Kansas Inspection Bureau report indicates that had the tank been one of the larger capacities, 3000 to 5000 gallons, which are common on the highways of Kansas, or had the accident occurred a few blocks north in the congested mercantile district, a major conflagration would undoubtedly have resulted.

Other Examples of Similar Fires.

On July 13 a 2½-ton gasoline transport truck was traveling too fast to make a jog in the road at the south end of Ottawa. The truck overturned, caught fire, and was destroyed. The driver was so badly burned that he died shortly after being taken to the hospital.

On June 29 a 4000-gallon gasoline transport truck crashed into a ditch and burst into flames at Altoona, 10 miles north of Neodesha, Kansas. The driver's clothing caught fire as he crawled from the wreckage. Before he died, he said that he believed he had fallen asleep after driving nearly all day and since midnight.

Fires of this kind resulted in the death of seven people and the loss of 18 or more trucks in Kansas last year. This year the fires and casualties are even greater in number. It is difficult to comprehend the number of gasoline

trucks that travel Kansas highways going directly through many cities and towns. In a single month it is reported that 6740 trucks passed through one State Port of Entry on the Nebraska border. It is also reported that around 600 trucks pass through the City of Newton every day. These figures include both empty and full trucks going in both directions. Much of this traffic is interstate, coming from Oklahoma and southern Kansas and going as far as Nebraska and Iowa.

Apparently several other states in addition to Kansas are affected by this hazard on the highways and are concerned with remedying it. Another typical example occurred on July 4, near Montmorenci, Indiana. Three men were burned to death and another critically injured when two transport trucks collided, turned over, and caught fire.

Efforts to Solve the Problem in Kansas.

The gasoline transport companies, which pay mileage taxes and claim the right to use the streets and highways, obtained a permanent injunction to restrain the Ottawa city officials from enforcing the ordinance which bars gasoline transport trucks from the streets of the town. It is reported that the Reno County district court refused to issue an order restraining the enforcement of the Newton ordinance. Suit was then filed in the Federal court.

The Ottawa Chamber of Commerce then started a movement for the adoption of a state law to prohibit the transportation of flammable oil products over the highways of the state in quantities exceeding 600 gallons.

An urgent need for suitable regulation of this life and property hazard is felt in Kansas, and the State Attorney General, State Fire Marshal, State Highway Department, the Kansas Inspection Bureau, and the League of Kansas Municipalities are making an effort to solve the problem. A conference on this subject was held at Topeka on August 14. All parties interested, including the oil and gasoline transport companies, were represented. Members of the oil industry admitted that a great many of the trucks in use were obsolete and in poor condition, and that several of the transport concerns are irresponsible. No action was taken except the appointment of a committee to study the problems involved in regulating this hazard.

The N.F.P.A. Committee Recommendations.

The fire hazard problem involved in the operation of gasoline transport trucks is of great interest to the N.F.P.A. not only because of the possibility of loss of life and property in highway fires, but because of the very real danger that truck fires may occur in congested districts of cities or towns where a large amount of property may be exposed. The Association has had for some years a standard prepared by the Committee on Flammable Liquids dealing with the construction of tank trucks. This standard calls for substantial construction of the tanks, design and maintenance of the chassis to minimize fire hazards and specifies various precautions to be taken in the opera-

tion of trucks, particularly as regards loading and unloading operations. The N.F.P.A. recommendations have been largely followed as a guide to good practice, have been adopted as regulations with the force of law in New Jersey and have been made the basis of state regulation in some other states. They have also been made the basis of Interstate Commerce Commission regulations for common carrier tank trucks engaged in interstate and foreign commerce. In New Jersey where these regulations have been enforced fires in connection with gasoline transportation have been reduced to a minimum.

The experience in Kansas and other states where long distance transportation of gasoline over the highways is found on a large scale, however, raises the question as to whether the existing standards of construction and maintenance of trucks are sufficient to control the hazard. It is recognized that no matter how safely a truck may be built or how well it is maintained, accidents are probable when trucks are operated by incompetent drivers or by men who are compelled to be on duty for such long periods that they are likely to go to sleep at the wheel. While proper truck and tank construction is valuable in minimizing the fire hazard in case of an accident, it is obvious that no matter how well built the tank, gasoline is likely to escape and be ignited in case of a crash at high speed.

The routing of long distance tank trucks through built up communities is another aspect of this problem. The plan of prohibiting tank trucks in towns as tried in Kansas places a serious hardship on the oil operators so long as the only main highway routes pass through settled communities.

The N.F.P.A. Committee on Truck Transportation, which was recently organized to consider various aspects of the highway transportation of combustible commodities, has this subject under consideration and is expected to make some report thereon in the near future.

When the driver of this gasoline tank truck and trailer fell asleep at the wheel the truck crashed into a tree on the highway near San Jose, Cal. The driver was burned to death and the 7500 gallons of gasoline which the truck and trailer contained was entirely consumed by the fire.

Ethylene Explosion, Lincoln, Neb.

Four men were killed and two were injured when an explosion of ethylene gas in a banana ripening room wrecked a building of the Grainger Bros. wholesale fruit warehouse in Lincoln, Nebraska, on August 12, 1936.

Construction and Occupancy.

The structure demolished in the explosion was two stories and basement in height with a small section three stories high, and covered an area of fifty-one by thirty-eight feet. There were two banana curing rooms and a packing room in the basement. On the first floor was another banana curing room covering two-thirds of the floor area and having a concrete floor. The remainder of the building was of joisted construction and was used for storage. The destroyed building adjoined several other plant buildings. On the north was a building of three-story brick-joisted construction and on the west was another of five-story mill construction. Across an alley to the south and connected by a tunnel was a five-story fire-resistive building. With the exception of the fire-resistive building, all plant buildings were under complete sprinkler protection.

Story of the Explosion.

The explosion occurred at 11:37 A.M. in a banana ripening room in the basement. At the time of the explosion, Mr. Grainger, the owner, had taken a fruit salesman into the basement, and there were also four workmen in the section. These men were all trapped by the débris. The explosion broke sprinkler piping, and the fire department responded to a sprinkler alarm which was sent in by the flow of water. Another alarm was sent by telephone, bringing additional companies. The first firemen to arrive found the building a mass of débris and were told that men were trapped in the basement. Fortunately no fire followed the original blast. Firemen were able to remove four of the trapped men through an opening where the explosion had blown out a double cork insulating partition, closing a former opening in the basement wall. The owner insisted that the other men be removed first, although he was pinned down by an ethylene gas cylinder across his body and a bunch of bananas across his neck. After these four men had been removed, it was apparent that tons of débris would have to be removed before the two remaining men known to be in the basement could be reached. A call was immediately sent for trucks and a tractor. The Iowa Nebraska Light and Power Company

Account prepared from reports by H. M. Davis, Nebraska State Fire Marshal (Member N.F.P.A.), Nebraska Inspection Bureau (Member N.F.P.A.), and Charles M. Horham, City Fire Inspector.

supplied a large truck with a power winch and the W P A gave able assistance with a truck and crew. Sections of roof and floors and tons of brick were removed. It was necessary to cut away part of the roof and remove one wall before workmen were able to enter the ruins and recover the bodies of the two remaining victims at 7:19 P.M. Two of the men previously removed had also received fatal injuries.

Cause of Explosion.

An investigation showed the explosion to have been due to ignition of ethylene gas by a lighted match. Tests by the City Fire Inspector with combustible gas indicators in adjoining basements and in manholes and sewers, as well as at floor drains in the wrecked building, eliminated both escaping natural gas and sewer gas as possible explosion causes. This investigation also showed that escaping ammonia vapors did not cause the explosion.

The banana ripening rooms were heated by open natural gas jets and in order to assist in ripening or coloring it was customary to "crack" the valve on a tank of ethylene gas and saturate the room. Instructions were given that gas jets should be turned off before the ethylene was used. This procedure was apparently followed.

According to statements by Mr. Grainger, the explosion occurred when the salesman who was with him struck a match to light his pipe. Mr. Grainger stated that he had cautioned the man against smoking. One of the victims when questioned in the hospital stated that ethylene was being used. Another employee who had left the room five minutes prior to the explosion stated that he heard gas coming from the cylinder and smelled the ethylene while in the basement. During the investigation on the day following the fire, one of the twenty-five-pound ethylene cylinders was located in another room. The valve was slightly open, the cap was off the orifice and the tank was empty. There was no regulating valve attached to the cylinder and there was no evidence that such a valve had been broken off. It is believed that the valve of the ethylene cylinder in use had either been removed or had never been attached and that gas was discharged at an abnormal rate, resulting in an ethylene concentration in the air in the explosive range, which is between three and twenty-nine per cent. One one-thousandth of one per cent of ethylene gas is the maximum concentration needed for the artificial ripening process.

Information as to the exact amount of the loss is not available. The building in which the explosion occurred was completely destroyed. Damage to adjoining buildings was moderate.

Pyroxylin Scrap Fires, Newark, N. J.

During the severe hot spell which occurred in July two serious fires took place in Newark, N. J., in plants handling pyroxylin and film scrap. The first fire occurred in the scrap pyroxylin sorting plant of Larry Gering, Inc., at 243-251 Parkhurst Street, July 9, 1936. This plant was destroyed, and burning scrap spread the fire over a considerable area, threatening a general conflagration and destroying or damaging several other plants. The second fire occurred early on the morning of July 12 in the Parkhurst Products Co., 250-252 South Street, engaged in reclaiming silver from scrap film. Although confined to the fire-resistive sprinklered building, the loss was considerable.

Larry Gering, Inc., Fire.

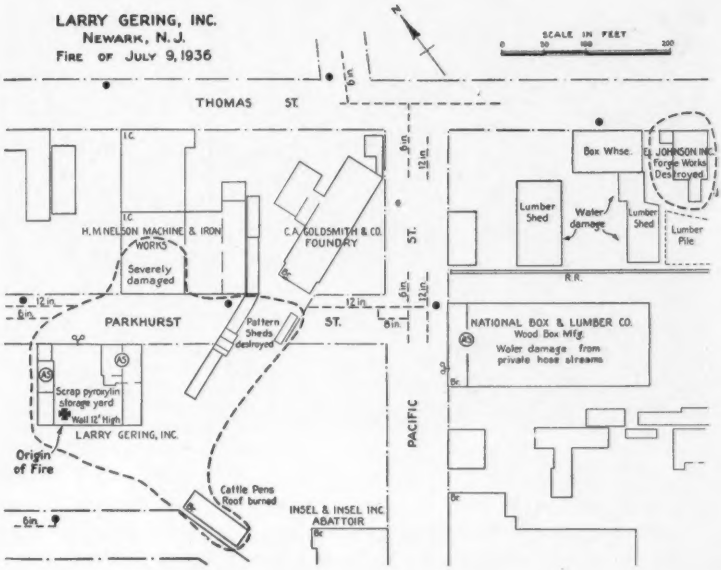
The fire which destroyed the plant of Larry Gering, Inc., on July 9, was the fourth fire on record in this plant since it was originally constructed in 1927. The first fire occurred in 1929 and practically wrecked the plant. Three alarms were sounded. In 1931 a two-alarm fire badly damaged the plant, injured several firemen, but was confined to the plant by sprinklers and hose streams. On June 27, 1936, a small fire at a scrap cutting machine was controlled by sprinklers.

Construction and Occupancy.

The plant consisted of two main buildings of concrete block, each one story in height, with composition covered joisted roof. The buildings were approximately one hundred feet long and twenty to forty feet wide and were subdivided by concrete block fire walls well parapeted through the roofs. Door openings in fire walls were protected by non-standard fire doors. Both buildings were completely protected by standard wet pipe automatic sprinkler systems. These sprinkler systems, while standard for ordinary occupancies, were far short of the sprinkler requirements in the N.F.P.A. Regulations for the Storage, Handling and Use of Pyroxylin Plastic. For loose pyroxylin scrap storage a sprinkler head is required by these regulations for each thousand pounds of scrap. Scrap pyroxylin is more hazardous than new pyroxylin stock due to foreign matter which may be present and because the used material is less stable and more readily subject to decomposition.

An open yard sixty to eighty feet in width separated the two buildings, and the entire plant was enclosed in a concrete block fire wall built to the height of the building parapets. Scrap pyroxylin, obtained from various sources, included manufacturing plant waste and old discarded X-ray film

Note: This account has been prepared from reports by the Schedule Rating Office of New Jersey (Member N.F.P.A.) and the Eastern Underwriters Inspection Bureau (Member N.F.P.A.).



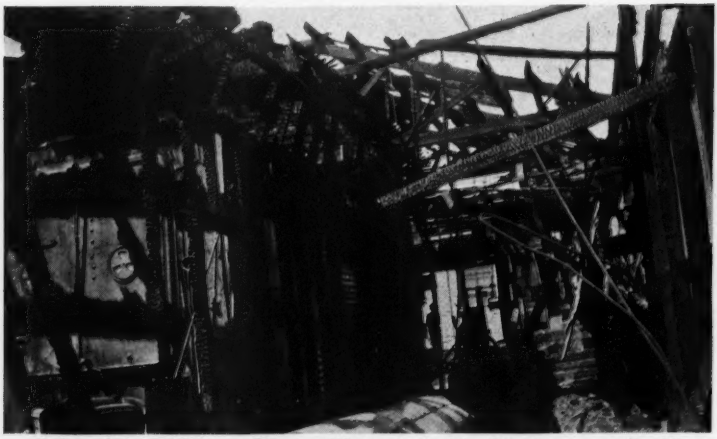
from hospitals and institutions. This was received at plant in sheet metal drums, wooden packing cases and in paper bags. This material was stored in the open yard as received and later brought into buildings to be sorted into lots of various colors and sizes, washed and dried by machine, cut to desired sizes, then repacked in wooden boxes and metal drums and again stored in the open yard, awaiting shipment. There was a considerable amount of scrap in the yard. Storage of scrap in the open is not recognized by the N.F.P.A. regulations.

Story of the Fire.

The fire occurred during a protracted hot dry period; the Weather Bureau reported a temperature of 105° in the city. The plant closed for the day at 5:00 P.M., but a single workman remained to finish sorting a batch of scrap. The night watchman also assisted in the sorting.

At about 6:30 P.M. these employees were startled by a muffled explosion. Fire seemed to burst into the building from the entire area of the yard simultaneously. The watchman ran through the building and escaped unharmed. The other employee, a boy of seventeen, started for the yard but was checked by flames and was seriously burned before escaping through the building.

Persons near the plant saw the flames and débris shooting high into the air and operated a fire alarm box, bringing three pumping engines, one hose truck, one ladder truck and two chiefs. Upon leaving fire headquarters a cap-



Ruins of the E. Johnson Forging Works ignited by burning pyroxylin débris. This plant was 650 ft. distant, air line, from the Gering plant, where the fire originated.

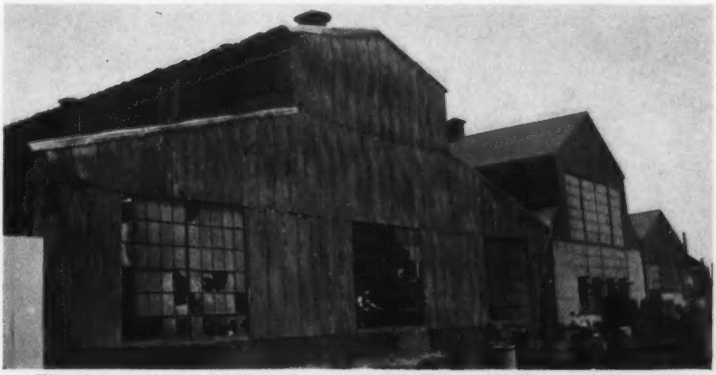
tain noted the amount of flame in the air and ordered a second alarm at 6:31 P.M. In all a total of four alarms and two special calls brought out twelve pumping engines, seven hose trucks, four ladder trucks and three rescue squads, with a total of 135 men.

The first companies to arrive directed heavy streams over the fire wall enclosure from an open field next to the plant. A light breeze was blowing the high flames across the street and they engulfed a steel constructed machine shop. The owner of this plant had issued orders to his employees to vacate immediately in case of a fire in the Gering plant and two workmen escaped without injury.

Heat from the rapidly burning nitrocellulose scrap was intense and was noticeable for a distance of hundreds of feet from the fire. Flames and burning débris filled the air and traveled several blocks. A tank truck was delivering gasoline to a filling station 550 feet distant. The heat was so intense that the driver drove the truck out of the area, fearing it might ignite. The very high temperature in the fire area made control of the fire very difficult. Firemen were unable to approach the fire from the street, but a hole was cut through the side of one of the buildings, which enabled them to do good work in wetting down the yard.

Spread of the Fire.

At the start of the fire fifty employees were working in the National Box and Lumber Co. plant 350 feet distant, opposite the end of Parkhurst Street.



Fire damaged the machine shop of H. M. Nelson Machine and Iron Works. Frame window sash in large lantern roof of this building, located directly across Parkhurst Street from the Gering plant, quickly ignited by the itense radiated heat.

The main building is used for the manufacture of wooden boxes and there are numerous sheds and lumber piles adjacent. These employees immediately formed bucket brigades and manned four private hose streams, wetting the roofs of these buildings. Within five minutes a shift of wind carried burning débris directly over the roof of this plant, which was saved by the employees.

When Chief Towey arrived on the second alarm he found that the sheds of the C. A. Goldsmith and Company aluminum foundry on Parkhurst Street and the roof of the brick cattle pens of Insel and Insel, Inc., abattoir, located one hundred feet from the rear of the Gering plant, were burning. As additional apparatus arrived, hose lines were placed to control these fires. The fire at this time had involved such an extensive area and hose lines were of such length that Chief Towey called on spectators to assist in hauling hose lines and driving cattle from the abattoir. About 7:00 P.M. the proprietor of the E. Johnson Forging Works, occupying a frame building two blocks from the Gering plant, found his building in flames. Pumpers were transferred to this blaze, but not before the building was destroyed.

Sprinkler Operation.

After the fire it was discovered that all sprinkler heads in the two buildings of the Gering plant had operated. Equipment located directly under sprinkler heads in one of the buildings was undamaged. Roof beams and roof boards were unburned where protected by sprinklers, and building walls were largely undamaged. Wooden roof joists in the sorting building were badly charred, but were mainly still in place after the fire. About fifty barrels of nitrocellulose scrap, which were in the buildings, were undamaged, but the contents of the open yard were completely destroyed.

This hole broken in one of the walls of the Gering plant was the only means by which the fire could be directly attacked by the fire department, as intense heat prevented access from the street in front. Automatic sprinklers aided in controlling the fire, making access possible near this opening.

Cause and Loss.

The fire is believed to have been caused by decomposition of nitrocellulose stored in the open yard due to the extremely hot weather.

Loss to the Gering plant was estimated at $15,000 out of a value of $30,000 for building and contents. Other losses, including the destruction of the E. Johnson, Inc., plant, brought the estimated total loss to over $100,000.

Parkhurst Products Corp. Fire.

The Parkhurst Products Corp. is a separate concern under the same management as Larry Gering, Inc., and is engaged in the recovery of silver from the coatings of old motion picture and X-ray film. Fire believed due to decomposition and ignition of nitrate film scrap occurred at 4:45 A.M. on the morning of July 12, 1936.

Construction and Occupancy.

The fire occurred in a one and two-story fire-resistive tenant manufacturing building having brick walls and concrete floors and roofs on a protected steel frame. The front or one-story portion of the building occupied by a concern manufacturing carpet sweepers was not materially involved in the fire.

The Parkhurst Products Corp. washed film for the recovery of silver. They attempted to restrict the stock to cellulose acetate, or slow burning film, and claimed that cellulose nitrate stock was sorted out promptly and removed when received in film scrap. However, it is known that up to ten per cent of the stock received might be nitrate stock and at times a total of several hundred pounds was present, either sorted or mixed with other stock. At the time of the fire the first floor, used for storage, contained considerable cased stock and the second floor housed the manufacturing operations and contained the greatest quantities of stock. These sections were protected by a standard

wet pipe sprinkler system with a single supply through a six-inch connection to a twenty-four-inch public main. This system was not designed for an occupancy having nitrocellulose or pyroxylin stock.

Story of the Fire.

The fire originated on the first floor. For four days prior to the fire, temperatures in excess of 100° F. had been recorded, which favored the decomposition of the stock. There was no recognized watchman service, but an unsupervised watchman employed by the other tenant was asleep in a chair in front of the building when the fire broke out. When the watchman first saw the fire it was under severe headway and he promptly gave an alarm through a public box. The fire department used ten hose streams, and practically all of the sprinklers, or about 125 heads in the rear section, operated. A large part of the contents of the first floor was destroyed, but some cases of cellulose acetate stock remained. On both floors there was evidence of the burning of cellulose nitrate stock in some of the containers. Apparently the operation of the sprinkler systems served to check the burning of the containers, although the contents burned out. As would be expected, the sprinkler operation was more effective on the first floor, for with the large number of heads open, the second floor did not receive sufficient water. Except for damage to windows and frames there was little damage to the building. Fire did enter through the exhaust duct to the spraying section of the other tenant, but was checked by sprinklers. Other near-by buildings also received moderate damage, including the breaking of windows and scorching of woodwork. The total damage in the fire was reported as large, but exact figures are not available.

On the whole, while there was evidence of burning of cellulose nitrate stock inside the building, it does not appear that there was the severe projection of flame that might be expected with the free burning of large quantities of cellulose nitrate stock, indicating that the action of sprinklers probably retarded the burning of this stock to an appreciable degree.

The Rapinwax Paper Co. fire, St. Paul, June 15, 1936. The fire originated in waste paper and rubbish under the unsprinklered frame loading platform. In the absence of fire doors and wired glass windows it spread rapidly into the main building (left).

Rapinwax Paper Co. Fire, St. Paul.

By John Townsend,
Superintendent, St. Paul Fire Insurance Patrol.
(Member N.F.P.A.)

The Rapinwax Paper Company, 293-5 West Como Avenue, St. Paul, Minnesota, suffered a severe loss from fire on June 15, 1936. The exact cause of the fire is not known, but it is thought that sparks from a switch engine on a spur track in the rear of the plant ignited some paper and rubbish under the adjacent loading platform. Employees who were unloading a freight car containing a shipment of paper first noticed the smoke coming from under the platform, which was of frame construction. One of them immediately sent in an alarm by telephone while the others fought the fire with chemical extinguishers. The platform was soon enveloped in flames and the employees were driven back into the building. The freight car also ignited, but was shunted down the tracks about two hundred yards away from the building.

On the arrival of the fire department flames had entered the main building on the first and second floors through a doorway and windows on the first floor and windows on the second floor. The fire traveled through the entire first and second floors and part of the frame structure on the third floor. The stock of finished rolls of paper in the basement was badly damaged and about twenty-five per cent of the plant machinery was damaged. Contributing factors in the large loss, which was in excess of $100,000, were the storage of 80,000 pounds of paraffin wax in the warehouse and the raw and finished stock of waxed paper in the main building. The damage to the main building was limited, due to its partly fire-resistive construction.

Construction and Occupancy.

The main building is two stories high with a small roof house. The walls are of brick with reinforced concrete floors and roof supported by concrete posts supplemented by wooden and iron posts in the basement. The warehouse and loading platform was located at the rear of the main building and was of sheet ironclad construction with wooden floors. There was an open space under the building. A small frame addition had been built on the third floor of the main building. The roof of the main building was of the same construction as the floors, with the idea that additional stories would be added if needed. There were two enclosed stairways protected by fire doors between the first and second floors and one between the second and third floors. The elevator shaft, extending from the basement to the third floor, was also com-

The Rapinwax Paper Co. fire, St. Paul, June 15, 1936. The original frame building is at the right. The addition is the frame loading platform. In the absence of fire doors and wired glass windows it spread rapidly into the main building (left).

pletely enclosed. Offices and a storeroom, occupying portions of the first and second floors, were partitioned off by hollow tile and plaster board partitions, with openings protected by fire doors. The fire did not enter the storeroom on the second floor, but burned through a plaster board partition into the offices. Doors to the warehouse were open at the time of the fire, but it is doubtful if they would have held the fire had they been shut, as they were of wooden construction. Windows were of ordinary glass set in wooden frames and they failed at the start of the fire. The building was in good condition, but did not belong to the Rapinwax Company. The building owner had completely ignored suggestions for fire safety, including recommendations for fire doors and wired glass windows on the warehouse side of the main building and wired glass windows on the west side of the building facing tanks of an oil storage plant.

The Rapinwax Company was operating twenty-four hours a day and had been in its present location since 1925, engaged in the manufacture of wax paper and bread wrappers. The process consisted of printing rolls of paper and running it through melted paraffin and then cooling and hardening by running it over a cold roller. Plain wax paper was made in the same way, except that printing was omitted. Paraffin wax was melted by steam in dip tanks heated to 150 degrees.

How the Fire Was Fought.

The first alarm was received at 12:25 P.M. Two engines, one squad, one truck company, a district chief and the fire insurance patrol responded. Upon arrival the entire loading platform, warehouse and the box car were burning. The squad company was detailed to put out the box car fire while the other companies attacked the fire in the warehouse. By this time it was discovered that the flames had entered the first and second floors of the main building and a special call was sent in at 12:32 P.M. for three more engine companies, one truck and one squad. These companies took six lines of hose into the main building. The fire was attacked on both floors of the building by streams taken in the doors and others directed in windows from ladders. Subsequent calls brought five more engines, one hose and one truck, making a total response of twelve engine and hose companies, three trucks, two squads and the insurance patrol. The principal attack was made from the front to hold the fire in the rear. A great deal of difficulty was encountered from the paraffin which was burning on the top of the water and was more difficult to extinguish than gasoline. Two engine companies were used to protect the adjoining oil storage plant, the tanks of which were only fifteen feet from the unprotected windows. These tanks were properly dyked and protected by safety valves, but were considered to be seriously exposed by the paper plant. The fire was under control by 2 P.M.

Extent of Loss.

Damage consisted of $19,000 loss to the building, $24,000 to the machinery and $64,000 to the stock. There was $250,000 use and occupancy insurance carried, with a loss of $8700. The Fire Department and Fire Insurance Patrol cleaned the water out of the building. This was a difficult job as there was about six to eight inches of water on the first and second floors. Both floors were of twelve-inch reinforced concrete, making it impracticable to drill holes through them. Another factor which added to the difficulty was the sagging of floors at several locations. These depressions formed pockets so that it was impossible to sweep water through stairway and elevator openings and the water had to be bailed out. Plant officials called in employees on all three shifts and had them clean out the débris so that the plant partly resumed operations two days later.

Conclusions.

1. This fire was a very good example of what would have been prevented by the installation of wired glass windows and fire doors, as had been recommended for this plant.

2. The space under the loading platform and warehouse should have been enclosed or at least equipped with small mesh wire underneath to prevent accumulation of paper and rubbish.

3. Complete automatic sprinkler protection would have prevented this fire from gaining such great headway and would have kept the fire out of the main building.

Benzol Explosion, Baltimore.

By Association of Fire Underwriters of Baltimore City,
(Member N.F.P.A.)

Two buildings and their contents were completely destroyed, four persons were killed and eight injured by a series of explosions and a fire resulting from the careless and illegal handling of benzol and other flammable liquids in the plant of C. A. Webb at 514 S. Eutaw Street, near the high value wholesale and manufacturing district of Baltimore, at 1:30 P.M. on July 11, 1936. Efficient work by the fire department confined the fire to the property involved in the explosions. (See Frontispiece.)

Construction and Occupancy.

The buildings involved were of ordinary brick-joisted construction. The building owned by C. A. Webb was four stories in height, eleven hundred square feet in area, with independent walls thirteen inches thick. There were unprotected openings on all floors. One side of the building faced an alley forty feet wide. The other side and rear adjoined a one and two-story ell-shaped structure covering an area of 3200 square feet and occupied by M. C. Fenton as a wholesale paper dealer.

The Webb property was occupied by C. A. Webb, A. L. Webb & Sons, American Commercial Alcohol Company, and Brokers' Inc., as wholesale distributors or brokers of such products as linseed oil, turpentine, paints, varnishes, shellac, alcohol, benzol, amyl acetate and butyl acetate. The alcohol, linseed oil, benzol, etc., were apparently stored in six storage tanks, of about two to eight thousand gallons capacity each, located inside the building. The details of original construction, installation and venting are not available. It was apparently the practice to fill drums and cans with these various materials. Reports indicate that shellac was thinned with alcohol, and cans and drums were at times repainted.

An inspection report of June 8, 1934, shows that, at that time, there was only one storage tank in the building, which was used for linseed oil. Limited quantities of amyl acetate and butyl acetate were on hand in sealed metal drums and moderate quantities of alcohol were stored in drums, barrels and cans. No benzol was being handled. Conditions apparently had materially changed since that time. The Building Inspector's Office reports that no permits were issued for the installation of tanks, other than the one for linseed oil, and that no permission had been granted for the storage and handling of benzol or other light volatiles, as would be required under existing ordinances. An application on June 5, 1933, for the installation of additional tanks and pumps had been refused.

Seventeen heavy hose streams were used by the fire department in controlling the burning flammable liquids and débris before it was possible to search the ruins for victims. (See Frontispiece.)

Story of the Fire.

Witnesses state that the first explosion blew out all windows, part of the front wall and most of the rear wall of the Webb building. A policeman one block distant heard the explosion and ran to the scene. He states that he found several injured persons in the street and called the police station in order to have them taken to the hospital. The first alarm was then transmitted at 1:40 P.M. When the firemen were within a block of the building, they saw a terrific explosion which blew out all of the remaining walls of the Webb building and one wall of the Fenton building above the second floor level.

The proprietor, who was standing in the front door of the Webb building, was blown to the street and seriously injured. Two employees in the basement were trapped and killed in the elevator at the basement level. Two office employees were at work on the second floor. One was killed, but the other fell with the collapsed floor to the street, receiving only scratches. One other employee was injured. A tenant, with a small office on the first floor, was fatally injured and a sewer department employee was seriously burned. At least six firemen were burned by exploding drums.

Firemen, upon arrival, found intense flames raging throughout the ruins of both buildings. The firemen played hose streams on the fire from all sides, but were hindered by exploding drums of flammable materials. They directed streams on the tank car, which they state was labeled "Benzol," and moved it from the vicinity. A total of seventeen streams were used, including one

from the water tower, and firemen prevented the fire from spreading to adjoining property. Fire shutters prevented the ignition of exposed buildings on two sides. The firemen could not search the ruins until about 6:00 P.M. At that time drums exploded while being moved and several firemen were badly burned. All apparatus was not recalled until 4:20 P.M. the following day.

Fire department response to six alarms, sounded within twelve minutes, included twenty-three engines, five ladder trucks, one water tower and six chief officers. Two alarms were also received from private boxes in near-by buildings.

Cause and Loss.

All persons engaged in the operations within the building were killed or seriously injured. No definite statement was obtained as to the cause of ignition of the benzol vapors, which are believed to have caused the explosion.

A customer of the Webb Company states that Mr. Webb called at about 11:30 A.M. and asked for about twenty-five empty drums so that he could remove all of the benzol from a tank car located in the street at the front of his property. A truck driver delivered the drums to the plant and went inside to get filled drums of alcohol and benzol. This man believes that they were not filling the drums at the time, but filled drums were on hand. He was loading the truck when the first explosion occurred. Being uninjured, he drove away from the property before the second explosion.

From interviews with persons who had been in the property, the following information about operations has been obtained: Tank cars were occasionally spotted on the railroad track in front of the building, and a two-inch pipe from the top of the car was brought down to a hole in the sidewalk at the building wall and connected to the two-inch piping in the building. Rotary pumps for emptying and filling purposes were belt driven from electric motors. There is no indication that the electrical equipment was explosion-proof or that any of the piping was grounded. All liquids, including the benzol, were pumped to the storage tanks or to connections for filling drums. The property was poorly maintained and very congested.

The outside temperature was 97 degrees and little wind was blowing. Assuming that operations were as outlined above, benzol vapors probably accumulated over the entire first floor. It appears impossible to locate the exact cause of the ignition, which may have been from one of the following: static electricity from pumping or filling operations; electrical equipment of the open type; or smoking. The first explosion probably broke a benzol pipe line or storage tank and the large volume of benzol then exposed provided the source of fuel for the second and most violent explosion.

The exact loss figures for this fire are not available, but it is obvious that the loss was considerable.

Distribution of Fire Loss by Occupancy Class.

By Warren Y. Kimball,
N.F.P.A. Fire Record Department.

The N.F.P.A. Executive Office has received numerous requests for information as to the distribution of fire losses by occupancy classes. Accordingly the Department of Fire Record has assembled this information for the year 1935 from available state fire marshals' reports. The figures shown in the following tables include only the states using a system of classification which is sufficiently similar to permit reasonable comparison. Other states for which 1935 fire loss figures are available use different systems of classification of fires and some states do not report their losses or make the report too late to be of value in this record.

The statistics assembled in this record are not intended to form a complete record of losses by occupancy classes, but rather to give, from the best data available, an indication of the proportion of the annual fire loss in each occupancy class. Figures are given showing the number of fires as well as the losses in these occupancies.

Table I shows the number of fires by occupancy reported for 1935 in ten states for which comparable figures are available. The basis of reporting fires varies in the different states. In some states the reporting service is more complete than in others. In the majority of the states in the group the figures include only fires causing a loss. Many small fires may be considered too trivial to be reported to state officials. Each of these is a potential conflagration, however, and in urban areas is included in fire department records if the department is called. There are also numerous trivial fires extinguished without the aid of public fire protection facilities, but for which claims are made to insurance companies. These losses may or may not be included in the state fire marshal's fire record, depending upon the system of loss recording followed. In many cases fire record data from rural sections not having organized fire protection facilities are obviously incomplete. In spite of these difficulties it is believed that the volume of data here assembled is sufficiently large to give a reasonable indication of the normal distribution of fire losses for the various occupancies. It is obvious that local conditions vary from the average. For example, the industrial losses will form a greater proportion of the total in the industrial regions of the country. Allowance should be made for such variations when consulting these tables.

In general it appears that the data in fire marshals' reports are more accurate in respect to the amount of loss than in respect to the number of fires, which vary greatly, depending on whether all fires are counted or only those where there is a material loss.

Table I. Number of Fires by Occupancy—1935.

Occupancy	Illinois	Iowa	Kansas	Montana	Ohio	**Oklahoma	Vermont	Washington	West Virginia	Wisconsin	Group Total
Apartment houses, flats and rooming houses	1,825	99	60	43	636	2	...	285	5	150	3,105
Bakeries	45	4	4	2	31	..	..	...	...	12	98
Barber shops, beauty shops, etc.	24	17	4	2	25	..	...	...	...	23	95
Barns and stables	438	166	128	16	960	24	*774	81	32	365	2,984
Chicken brooders, poultry houses	...	63	...	5	83	3	...	23	...	67	244
Churches	72	27	14	3	35	1	8	11	4	45	220
Depots, stations, waiting rooms	8	7	3	1	...	...	...	...	...	...	19
Dry cleaning plants, tailor shops	28	18	9	1	29	4	...	...	2	31	122
Dwellings, cottages, cabins	6,073	2,722	1,469	347	7,878	234	975	2,846	337	6,428	29,309
Elevators, granaries, grain warehouses	52	24	13	3	...	...	...	...	...	11	103
Factories (miscellaneous)	254	26	22	2	234	2	21	58	9	141	769
Foundries and metal workers	23	18	1	2	...	...	3	4	...	23	74
Woodworkers, including saw and planing	6	1	1	1	...	6	9	72	...	2	98
Flour and feed mills	6	8	1	...	...	...	1	...	...	12	28
Garages	717	190	158	32	809	36	27	‡69	28	219	2,285
Filling stations	43	30	17	4	65	1	...	...	...	32	192
Halls (lodge, club, dance, etc.)	33	14	13	10	34	...	7	32	3	43	189
Hospitals, institutions	11	2	4	1	5	..	...	10	1	10	44
Hotels and boarding houses	273	26	11	18	47	...	17	32	12	87	523
Ice houses	5	3	1	1	...	...	...	...	...	1	11
Laundries	27	9	2	1	13	1	1	...	6	11	71
Mercantiles	1,088	273	144	47	930	34	222	475	29	617	3,859
Office buildings, banks, etc.	109	44	24	6	28	4	...	21	10	40	286
Packing plants, stock yards, smoke houses	33	8	...	1	21	...	...	3	...	188	254
Power houses, pump houses, engine houses	10	12	2	1	...	...	6	7	1	45	84
Printing plants	...	8	..	...	19	...	...	5	...	14	46
Public buildings, libraries, etc.	1	2	...	4	...	...	3	...	...	5	15
Restaurants and saloons	222	72	17	14	77	12	3	68	6	166	657
Sheds	422	57	55	11	344	2	...	42	15	50	998
Shops (carpenter, blacksmith, plumbing, etc.)	41	23	12	4	122	...	...	...	8	26	236
Schools (colleges, seminaries, etc.)	54	27	16	9	38	4	9	22	8	65	252
Theatres and motion picture houses	32	15	12	5	30	6	2	15	5	18	140
Warehouses	61	56	4	7	131	8	10	77	9	66	429
Miscellaneous building fires	498	118	171	5	†305	23	4	45	2	102	1,273
Outside of buildings:											
Automobiles, buses, trucks	1,404	420	168	...	979	17	...	...	7	640	3,635
Cars (railway, electric, etc.)	61	13	4	...	24	...	...	...	1	16	119
Grain and hay	68	25	6	...	...	...	...	82	...	17	198
Junk yards	22	...	2	...	...	...	...	...	...	3	27
Lumber yards	10	6	3	2	14	...	...	...	...	7	42
Oil storage plants, refineries, etc.	3	4	9	2	16	1	1	2	...	...	35
Miscellaneous outside fires	34	...	5	4	...	...	...	5	...	7	58
Total	14,136	4,657	2,589	617	13,962	425	2,103	4,392	540	9,805	53,226

*Includes farm dwellings.
**Tulsa and Oklahoma City not included.
†Includes 115 awning fires.
‡Includes filling stations.

Number of Fires.

Table II is a recapitulation of the state totals presented in Table I with a column added to show the number of fires reported per 1000 population. It will be noted that with a few exceptions the figures are reasonably uniform. In Oklahoma and West Virginia the returns are admittedly incomplete. The much greater number of fires per thousand population in Vermont is partly due to the record system employed in that state.

It will be observed that a total of 53,226 fires were reported in 1935 for this group of ten states, having a total population of 27,777,877 in the 1930 U. S. census. This number of fires, as stated previously, is obviously less than the actual number of fires which have occurred. From a study of the best data available, including the individual records of various cities in the states included in this tabulation, it appears that the number of fires reported represent approximately half of the total number of fires for the year. In estimating the probable number of fires occurring in the entire United States 100% has therefore been added to the total arrived at from the various state reports. The accuracy of these estimates may be further checked from the reports of the Dominion Fire Commissioner of Canada, which are more complete than any figures published in the United States. These reports show a total of 42,468 fires in the Dominion in 1935, which number is nine per cent of the N.F.P.A. estimate of the number of fires in the United States. Similar percentage is noted in that the population of Canada is also nine per cent of that of the United States.

Table II. Number of Fires by States.

	Population	No. Fires	No. Fires per 1000 Population
Illinois	7,607,684	14,136	1.85
Iowa	2,467,900	4,657	1.88
Kansas	1,879,946	2,589	1.38
Montana	536,332	617	1.10
Ohio	6,639,837	13,962	2.10
Oklahoma	*2,065,113	425	.21
Vermont	359,611	2,103	5.85
Washington	1,561,967	4,392	2.81
West Virginia	1,729,205	540	.31
Wisconsin	2,930,282	9,805	3.35
Total	27,777,877	53,226	1.92
Estimated U. S. Total	122,700,000	470,000	3.83

*Excluding Oklahoma City and Tulsa.

Loss by Occupancies.

Table III gives the loss by occupancy class for a group of eight states representing a total population of 29,268,499, or nearly one quarter of the total United States population in 1930. These states reported a total loss of $40,901,050.

Table III. Loss by Occupancy—1935.

Occupancy	Illinois	Iowa	Kansas	Ohio	Texas	Vermont	Washington	Wisconsin	Group Total
Apartment houses, flats and rooming houses	$332,956	$54,492	$22,422	$462,528	$106,119	.....	$49,943	$54,339	$1,082,799
Bakeries	13,518	495	477	19,897	12,289	.....	.....	804	47,480
Barber shops, beauty shops, etc.	4,895	8,136	985	4,704	.....	.....	.....	7,816	26,536
Barns and stables	615,571	250,727	176,132	1,618,896	*449,905	**$744,994	62,327	554,971	4,473,523
Chicken brooders, poultry houses	.....	18,208	.....	31,942	....	.....	9,197	22,831	82,178
Churches	122,914	54,738	35,899	60,418	31,029	3,869	2,822	267,286	578,975
Depots, stations, waiting rooms	2,700	3,831	70	.....	600	.....	.....	.....	7,201
Dry cleaning plants, tailor shops	4,208	4,174	23,063	9,618	.....	.....	.....	18,120	59,183
Dwellings, cottages, cabins	2,761,151	1,189,878	853,556	3,414,585	2,397,188	270,368	1,125,050	1,824,734	13,836,570
Elevators, granaries, grain warehouses	526,589	85,745	204,776	.....	50,864	.....	.....	1,910	869,884
Factories (miscellaneous)	714,422	111,448	45,372	898,906	111,832	15,518	137,655	399,528	2,434,681
Foundries and metal workers	25,848	64,668	89	.....	1,136	5,578	15,399	55,651	168,369
Woodworkers, including saw and planing	355	50	1,600	.....	17,706	30,900	429,615	7,774	488,000
Flour and feed mills	124,125	22,605	200	.....	4,783	11,459	.....	10,213	173,385
Garages (public and private)	257,923	120,179	43,839	240,410	30,887	14,551	‡29,773	74,278	811,840
Filling stations	11,503	10,421	3,485	20,519	***.....	.....	.....	15,381	61,309
Halls (lodge, club, dance, pool, etc.)	29,020	7,283	32,038	62,388	.....	15,430	14,565	47,484	208,208
Hospitals, institutions	3,870	136	4,735	187	3,338	.....	13,461	4,968	30,695
Hotels and boarding houses	118,334	103,070	4,850	8,114	28,411	16,885	1,639	143,433	424,736
Ice houses	12,175	55	10	.....	.....	.....	.....	412	12,652
Laundries	27,881	2,392	337	27,284	13,138	15	.....	19,967	91,014
Mercantiles	950,930	515,385	322,887	1,730,375	1,561,051	152,690	353,768	679,260	6,266,346
Office buildings, banks, etc.	45,484	27,298	83,281	48,543	.....	.....	36,203	17,515	258,324
Packing plants, stock yards, smoke houses	4,263	845	.....	10,714	1,079	.....	4,857	14,316	36,074

Occupancy	Illinois	Iowa	Kansas	Ohio	Texas	Vermont	Washington	Wisconsin	Group Total
Power houses, pump houses, engine houses	15,179	8,740	35,900	.....	15,516	3,800	5,977	16,874	101,986
Printing plants	.....	1,721	.....	59,083	.....	.....	6,647	1,249	68,700
Public buildings, libraries, etc.	150	246	.....	.....	30,054	906	.....	244	31,600
Restaurants and saloons	249,449	48,765	14,728	85,107	.....	318	35,556	104,742	538,665
Sheds	77,031	2,224	8,877	39,511	.....	.....	35,672	20,803	184,118
Shops (carpenter, blacksmith, plumbing, etc.)	11,523	6,717	8,847	78,117	.....	.....	.....	17,736	122,940
Schools (colleges, seminaries, etc.)	131,109	51,380	61,504	26,209	240,666	2,155	104,247	108,160	725,430
Theatres and motion picture houses	188,976	189,056	13,408	48,936	30,437	10,399	5,793	17,394	504,399
Warehouses	199,595	77,723	14,350	858,106	††286,457	10,269	244,945	115,655	1,807,100
Miscellaneous building fires	2,314,831	66,447	75,872	†230,733	300,414	4,298	39,947	95,866	3,128,408
Cotton warehouses, gins, compresses and yards, etc.	.....	.....	.....	.....	.....	.....	.....	.....	.....
Outside of buildings:									
Automobiles, buses, trucks	76,500	33,837	15,920	36,801	.....	.....	.....	70,822	233,880
Boats	.....	.....	.....	.....	.....	.....	.....	.....	.....
Cars (railway, electric, etc.)	101,256	1,192	73,060	5,868	13,315	.....	.....	2,323	197,014
Grain and hay	5,027	2,266	2,165	.....	.....	.....	55,125	2,249	66,832
Junk yards	7,612	.....	850	.....	.....	.....	.....	2,298	10,760
Lumber yards	80,375	47,145	19,010	103,709	8,922	.....	.....	51,955	311,116
Oil storage plants, refineries, wells, etc.	7,950	8,675	28,760	1,507	241,417	.....	.....	.....	288,309
Miscellaneous outside fires	14,803	.....	108	.....	19,750	507	12,753	1,910	49,831
Total	$10,192,001	$3,202,393	$2,233,462	$10,243,715	$6,008,363	$1,314,909	$2,832,936	$4,873,271	$40,901,050

*Includes farm dwellings and livestock.
**Includes farm dwellings.
***Filling stations reported under oil plants.
†Includes awning fires.
††Includes cotton warehouses, gins, compresses, yards, etc.
‡Includes filling stations.

Table IV is a recapitulation of the state totals included in Table III, with the addition of a column to show the per capita loss represented by the losses reported. It is interesting to note that the per capita loss for the group is reasonably close to the preliminary figure for 1935 published by the National Board of Fire Underwriters based upon loss reports made by insurance companies which are members of the National Board. The figures of the National Board include thirty per cent added for unreported losses. It is believed that at least forty per cent should be added to the total state fire loss figures used in the present tabulation, as many small fires for which claims are made to insurance companies are not reported to the state fire marshals. The addition of forty per cent makes the per capita loss figure for 1935 in this group of states very near to the estimate of the National Board of Fire Underwriters.

Table IV.

	Population	1935 Loss	Loss per Capita
Illinois	7,607,684	$10,192,001	$1.34
Iowa	2,467,900	3,202,393	1.22
Kansas	1,879,946	2,233,462	1.19
Ohio	6,639,837	10,243,715	1.55
Texas	5,821,272	6,008,363	1.03
Vermont	359,611	1,314,909	3.66
Washington	1,561,967	2,832,936	1.81
Wisconsin	2,930,282	4,873,271	1.66
Total	29,268,499	$40,901,050	$1.40
Nat'l Board Estimate of U. S. Total	127,520,000	$248,763,856	$1.95

Table V is an estimate of the 1935 fire record by occupancies, showing the probable number of fires and losses for each class. These figures have been prepared from the experience of the groups of typical states shown in Tables I and III. The estimates of the number of fires have been arrived at by applying the experience of the ten states in Table I to the entire United States and adding 100 per cent for unreported losses as previously explained. The estimate of loss for each occupancy was made by applying the experience of the eight states reported in Table III to the United States and adding forty per cent for unreported losses. This brings the loss estimate to the approximate amount of the 1935 United States fire loss preliminary estimate by the National Board of Fire Underwriters. As has been previously emphasized, these fire experience figures are only approximate estimates, but give within reasonable limitations an indication of the distribution of losses by occupancy classes and are the most reliable data available. Care should be taken in using these figures to make allowance for variable local conditions.

Table V. Estimated Distribution of Fire Losses by Occupancy Class, 1935.

These figures are only intended to show the relative order of magnitude of fire losses by occupancies and should not be taken as exact records for each class.

Occupancy	No. of Fires	Loss
Apartment houses, flats and rooming houses	27,400	$6,600,000
Bakeries	900	289,000
Barber shops, beauty shops, etc.	800	163,000
Barns and stables	26,300	27,200,000
Chicken brooders, poultry houses	2,200	501,000
Churches	1,900	3,535,000
Depots, stations, waiting rooms	200	44,000
Dry cleaning plants, tailor shops	1,100	361,000
Dwellings, cottages, cabins	258,800	84,300,000
Elevators, granaries, grain warehouses	900	5,300,000
Factories (miscellaneous)	6,800	14,850,000
Foundries and metal workers	600	1,027,000
Woodworkers, including saw and planing	900	2,980,000
Flour and feed mills	200	1,060,000
Garages (public and private)	20,200	4,950,000
Filling stations	1,700	374,000
Halls (lodge, club, dance, pool, etc.)	1,700	1,270,000
Hospitals, institutions	400	187,000
Hotels and boarding houses	4,600	2,588,000
Ice houses	100	77,000
Laundries	600	555,000
Mercantiles	34,100	38,200,000
Office buildings, banks, etc.	2,500	1,578,000
Packing plants, stock yards, smoke houses	2,200	220,000
Power houses, pump houses, engine houses	700	621,000
Printing plants	400	419,000
Public buildings, libraries, etc.	200	193,000
Restaurants and saloons	5,800	3,296,000
Sheds	8,700	1,123,000
Shops (carpenter, blacksmith, plumbing, etc.)	2,100	750,000
Schools (colleges, seminaries, etc.)	2,200	4,420,000
Theatres and motion picture houses	1,200	3,080,000
Warehouses	3,800	11,020,000
Miscellaneous building fires	11,200	19,100,000
Outside of buildings:		
Automobiles, buses, trucks	32,100	1,425,000
Cars (railway, electric, etc.)	1,000	1,203,000
Grain and hay	1,700	408,000
Junk yards	400	66,000
Lumber yards	300	1,897,000
Oil storage plants, refineries, wells, etc.	300	1,760,000
Miscellaneous outside fires	800	304,000
Estimated total	470,000	$248,994,000

NOTE: As explained in the text, 100 per cent has been added in estimating the number of fires and forty per cent has been added to the losses to cover unreported fires and losses.

Fire Record of Coffee and Spice Plants.

The universal use of coffee created a demand for 1,504,770,000 pounds of coffee in the United States during 1934. The exact amount of spices processed is not available, but in 1931 there were 917 coffee and spice plants, each producing products of a value in excess of $5000, or a total of $271,494,581, according to statistics of the U. S. Bureau of Census. As many of these plants prepare both coffee and spices, this record includes the two subjects, although the major hazards in the processing of the two products differ. The following tabulations are based on reports of 254 fires in these plants reported to the N.F.P.A. Department of Fire Record since 1894. The reports, furnished for the most part by member insurance inspection organizations, are believed typical of other fires occurring in this occupancy for which no reports have been made.

The following table gives the causes of fires arranged according to the processes involved. Fires resulting from coffee roasting processes were responsible for 41.3 per cent of the fires occurring in this record. Spice grinding fires amounted to 15.8 per cent of the total number, and coffee cooling process fires contributed 6.7 per cent. These three processes were responsible for more than 92 per cent of the special hazard fires, which were in turn 69.3 per cent of all fires in the present record.

Causes of Fires.

	No. Fires	Per Cent
Coffee roasting:	105	41.3
Spark from roaster ignited chaff in blower system or stack	32	12.6
Chaff in exhaust pipe or flue ignited from unknown cause	21	8.3
Overheating of coffee in roaster	18	7.1
Belt slipped off pulley or broke, causing overheating	6	2.4
Friction at roaster, machinery left operating	6	2.4
Heat from roaster or chaff drum ignited floor	3	1.1
Dust in roaster ignited by gas burner	2	.8
Bagging strings in roaster ignited	3	1.1
Chaff in exhaust pipe ignited by hot coffee	2	.8
Unknown at dust bin	2	.8
Hot ashes from roaster ignited floor	1	.4
Hot coffee left in roaster ignited	1	.4
Spontaneous ignition of wet coffee on oven	1	.4
Natural gas explosion at roaster	1	.4
Hot coffee from roaster ignited	1	.4
Flue from roaster became disconnected	1	.4
Backfire at roaster	1	.4
Sparks from roaster ignited coffee	1	.4
Dirt in roaster fan	1	.4
Unknown at roaster	1	.4

	No. Fires		Per Cent
Coffee cooling:		17	6.7
Hot coffee in cooling pan ignited	4		1.6
Spark from roaster drawn to pipe from cooling drum	2		.8
Spontaneous ignition of coffee bean oil while cooling	2		.8
Hot chaff dumped in cooling bins	3		1.1
Spark in chaff pipe	1		.4
Hot coffee ignited woodwork	1		.4
Hot coffee in chaff pipe	1		.4
Unknown in cooling pipe or pan	2		.8
Unknown in fan from coolers	1		.4
Spice grinding:		40	15.8
Foreign materials in spice mill	33		13.0
Friction in mill	4		1.6
Spark from grinder	2		.8
Spontaneous ignition at grinder	1		.4
Miscellaneous special hazard fires:		14	5.5
Sparks from coffee grinder	3		1.2
Friction of pulley at coffee grinder	1		.4
Spark from roaster carried to packing room	1		.4
Spark from spice grinder carried to stock room	1		.4
Hot coffee put in rubbish can	1		.4
Laboratory fire—chemicals boiled over	1		.4
Spontaneous ignition of pepper mixture	3		1.2
Spontaneous ignition of ground cinnamon	2		.7
Spontaneous ignition of sage	1		.4
Total special hazard causes:		176	69.3
Common hazard causes:			
Electrical	8		3.1
Smoking	7		2.8
Exposure	6		2.4
Hot ashes against combustibles	3		1.2
Spontaneous ignition of rubbish	3		1.2
Sparks from boiler ignited rubbish	2		.8
Spontaneous ignition of coal	2		.8
Incendiary	2		.8
Rubbish ignited from unknown cause	4		1.6
Miscellaneous common hazard causes (one fire each)	7		2.8
Total common hazard causes		44	17.3
Unknown causes		34	13.4
Total		254	100.0

The following fires are typical of the special hazard fires reported.

Coffee Roasting.

The greatest number of fires were due to ignition of chaff or dust in the exhaust ducts usually by a spark from the roaster. The second greatest cause in connection with this process was the overheating of coffee in the roasters.

SAN FRANCISCO, CALIF., SEPTEMBER 8, 1923. Fire occurred in a gas heated coffee roaster on the fifth floor of a fire-resistive building. The roaster was regulated for a four hundred pound charge of coffee. An eighty pound charge which went in unobserved was overheated and ignited. One sprinkler over the roaster operated and held the fire in check until extinguished by employees with first aid equipment. The loss was $150. (S-35574.)

ROCHESTER, N. Y., APRIL 10, 1930. Fire occurred in a coffee roasting cylinder on the fifth floor. The operator was making a French roast, which is

made by roasting until the coffee bean is quite dark and the oil has begun to appear on the surface. After bringing out the usual color on the bean the gas was shut off and the roaster was allowed several more revolutions. As the operator was about to dump the cylinder of coffee into the cooling pan he noticed fire in the cylinder. The operator called the fire department and used a hose stream on the blaze. He failed, however, to shut off the blower fan, which continued to fan the fire until the coffee was dumped into the cooling pan. When the coffee was dumped, the heat immediately opened three sprinklers, which controlled the fire. The loss of $500 was largely due to water. (S-53520.)

SAN FRANCISCO, CALIF., SEPTEMBER 6, 1934. Fire occurred in a coffee roaster on the fifth floor of the five-story fire-resistive building. The roaster stopped, allowing the coffee to be ignited by the gas roasting flame. Fire spread to chaff in the monitor on the roof and also to chaff on the roof. One sprinkler extinguished the fire in the roaster and a hand hose stream was used on the roof. The loss was small. (S-67332.)

ROME, N. Y., JANUARY 30, 1935. Fire occurred in the coffee roasting room on the second floor of a three-story frame ironclad building. Coffee, being roasted very dark for foreign users, became too hot and when dumped it burst into flame. Employees immediately used chemical extinguishers. About the time the fire was out three sprinklers operated, sending an alarm to the fire department. The loss of $210 was due to water. (S-70727.)

SAN FRANCISCO, CALIF., FEBRUARY 27, 1935. Fire started in the exhaust duct above the coffee roaster on the fifth floor. Some combustible material entered the roaster with the coffee and was carried into the duct by the exhaust fan. In controlling the fire the coffee was dumped and a small hose was used from below as well as from above through the cyclone. Sprinklers did not operate, as the fire was confined to the exhaust system. There was no loss. (S-68817.)

ALBANY, N. Y., MAY 27, 1935. Fire in the roasting room occurred in the metal can in which the chaff was deposited. A spark from the coffee roaster was carried to the can by the blower system, igniting the chaff. The fire evidently smouldered for some time, as the roasters had been shut off for several hours when the local sprinkler alarm bell was heard by the janitor. One sprinkler practically extinguished the fire. The loss was $180. (S-70746.)

TORONTO, ONT., AUGUST 15, 1935. Fire occurred in a coffee roasting plant on the second floor of a brick tenant manufacturing building. A spark drawn from the roaster through the fan ignited some material in the exhaust pipe. One sprinkler operated, sounding an alarm to the fire department through a supervisory station, and firemen used chemical extinguishers in controlling the blaze. The loss was $53. (S-70917.)

GENEVA, N. Y., OCTOBER 28, 1935. Fire occurred in the coffee roasting machine as the operator stepped out of the room for a few minutes after placing a fresh batch of coffee in the roaster. While he was absent the leather belt broke which operates the perforated rotating drum in which the coffee is placed. The drum stopped and allowed the gas flames to come in direct contact with the coffee, which ignited. The blower drew the fire inside the metal exhaust ducts, igniting dust in the duct. The employee shut down the blower when he returned and the fire was extinguished with chemicals. The loss was $142. (S-71145.)

Coffee Cooling.

Next to roasting, the greatest number of fires due to the processing of coffee occur during cooling operations. Hot coffee taken from the roaster sometimes ignites while cooling, either spontaneously or due to the increased air circulation in the coolers. In some instances hot coffee ignites near-by combustible material. Other fires occur in the exhaust ducts due to ignition of chaff. In installations where the same ducts also serve coffee roasters, sparks from the roaster may ignite chaff in the pipes from the cooling drum. The following fires are typical.

MONTREAL, P. Q., OCTOBER 1, 1930. Fire occurred in a coffee cooler consisting of a shallow sheet iron pan with perforated bottom. Air from the room is sucked downward through the beans and exhausted out of doors. The fire was caused by the beans becoming overheated in the roaster and when dumped into the cooler the draught of cooling air caused ignition. The fire damaged the bottom of the cooler and the metal vent and conveyor pipes. (S-54650.)

SAN FRANCISCO, CALIF., SEPTEMBER 25, 1931. Chaff in the coffee cooler on the fifth floor was ignited by a hot coffee bean or from a piece of string which had ignited. Fire came out of an open section of collector pipes and fused one sprinkler. A flooding system for the cyclones and collector system was opened, keeping the fire out of the cyclones. Chemical extinguishers and hand hose were used to extinguish the fire. The loss was small. (S-58921.)

NEW YORK, N. Y., DECEMBER 16, 1932. Fire occurred in a coffee roasting plant on the sixth floor of a ten-story fire-resistive building. The fire was due to spontaneous ignition of the natural oil contained in the coffee bean while cooling in a large metal tray with ventilating holes in the bottom and sides. A small hand hose was used to extinguish the fire, which was of a smouldering nature. The loss was $54. (S-63778.)

Spice Grinding.

Most of the fires occurring during spice grinding operations are due to foreign material in the grinder. The following fires are typical.

ELMHURST, L. I., N. Y., MARCH 26, 1930. Fire occurred at a cinnamon grinding machine on the fourth floor. The machines were equipped with electro-magnets to remove metals from the bark before it falls into the grinder. The operator failed to clean the magnets before shutting them off and a piece of metal fell into the grinders. This caused a spark which dropped into the tin-lined screw conveyor beneath the machine. The powdered cinnamon ignited, but since the conveyor was totally enclosed it did not immediately burst into flame. The conveyor and the worm were damaged by the smouldering fire during the night. A watchman reported in the morning that he had noticed some "funny odors," but failed to locate the fire. The loss was $75. (S-55400.)

PORTLAND, ME., AUGUST 16, 1932. Foreign material in an inferior lot of cloves entered a clove grinding machine and caused a spark which ignited the canvas bellows on the receiver. The fire was quickly extinguished by employees with hand chemicals. The loss was $60. (S-62874.)

BROOKLYN, N. Y., MARCH 2, 1933. Fire occurred in a sifter and dust collector attached to a cinnamon grinding mill which had been operated until 5 P.M. of the evening of the fire. The mill was equipped with magnets, but

some foreign substance passed through, causing a smouldering blaze which eventually burned through the top of the machine and operated one sprinkler at 10:17 P.M., sounding an alarm. The loss was small. (S-63518.)

ELMHURST, L. I., N. Y., JUNE 19, 1933. A piece of metal passed the magnets and entered the cinnamon grinder, causing sparks which ignited the cinnamon. The sparks were blown through the conveyor to the dust collector, and partitions of the wooden frame of the conveyor ignited. Two sprinklers operated and practically extinguished the fire. The loss was $500. (S-64491.)

Point of Origin of Fires.

As a supplement to the data on causes of fires it is interesting to note where the fires originated.

Point of Origin.

	No. of Fires	Per Cent
Coffee roasting room	66	26.0
Coffee roaster exhaust stack, ducts, or cyclone	52	20.5
Spice grinding room	49	19.3
Storage room	19	7.5
Coffee cooling room	12	4.7
Packing or shipping room	10	3.9
Outside—exposure	9	3.5
Basement—boiler room	9	3.5
Waste paper room	2	.8
Coffee grinding and sifting	2	.8
Miscellaneous known locations (one fire each)	9	3.5
No data	15	6.0
Total	254	100.0

Construction of Plants.

The plants in which the fires occurred were of better than average construction. Over fifty per cent of the buildings where the construction was reported were of fire-resistive or heavy timber construction. This is probably due to the fact that the larger coffee and spice plants occupy substantial buildings and the plants of moderate size frequently occupy a portion of large multiple tenant factory buildings.

Construction of Plants.

	No. of Fires	Per Cent
Brick or stone-joisted	72	40.4
Brick—plank and timber or mill	48	26.9
Fire-resistive	44	24.7
Frame	11	6.2
Frame—ironclad	3	1.8
Total known	178	100.0
No data	76	
No data	254	

Record of Automatic Sprinklers.

The performance of automatic sprinkler equipment in coffee and spice plants has been very satisfactory and is above the average for all occupancies. Because of the likelihood of fires in coffee roasting and spice grinding processes sprinklers are especially desirable and valuable.

Sprinkler Operation.

	No. of Fires	Per Cent
Entirely or practically extinguished fire	106	72.1
Held fire in check	38	26.4
Total satisfactory	144	98.5
Unsatisfactory	3	1.5
Total	147	100.0

A brief explanation should be made of the three fires in which the sprinkler operation was not satisfactory. In at least two of the three fires the unsatisfactory operation was due to failure of the human element, which might have occurred in any occupancy.

CHICAGO, ILL., FEBRUARY 15, 1918. The watchman shut off the sprinkler system too soon and before the fire department arrived, allowing the fire to gain headway. A loss of $300,000 resulted. (S-22965.)

FORT SMITH, ARK., OCTOBER 22, 1918. A gas pipe supplying natural gas to the coffee roasters was broken and the gas ignited. A terrific explosion wrecked the building, killing five employees and spreading fire. The loss was $185,000. (S-24158.)

PHILADELPHIA, PA., JANUARY 13, 1919. A portion of the sprinkler system was shut off at the time of the fire from an unexplained cause. The fire caused a loss of $350,000. (S-24638.)

Losses.

The following table has been prepared to show the comparison of losses between sprinklered and unsprinklered plants. With the exception of the three large loss fires mentioned above, the loss record in the sprinklered plants has been excellent. In the unsprinklered plants, however, forty-two per cent of the fires reported to the N.F.P.A. were in the upper loss brackets.

Losses.

	Sprinklered	Unsprinklered	Total
Under $1,000 or "small"	166	26	192
$1,000 to $4,999 or "moderate"	25	3	28
$5,000 to $9,999	2	1	3
$10,000 to $24,999	0	8	8
$25,000 to $100,000	0	7	7
Over $100,000	3	0	3
Large (no exact data)	0	7	7
No data	1	5	6
Total	197	57	254

How Discovered.

Another factor contributing to the favorable loss record shown above is found in the following table, which shows a high percentage of fires discovered by automatic means. A large number of coffee and spice plants have central station sprinkler alarm and other forms of automatic alarm service. Only fourteen per cent of the fires were discovered by persons outside of the plant, although forty per cent of the fires occurred while the plant was not in opera-

tion. Sprinkler supervisory systems transmitted sixty-six alarms and were the first means of notification in forty-nine of these fire. The record of watchmen is also good. In nineteen instances watchmen first discovered the fire, in six other cases they investigated upon hearing the local sprinkler alarm. In twelve fires watchmen or employees transmitted alarms over central station supervisory boxes. Local sprinkler alarms gave the first notification of ten fires, but failed to operate in five instances, showing the need of supervised alarm services. Two of these failures were due to shutting off of the water motor gong. Others were due to a weak battery, closed sprinkler valve, and an inoperative bell.

How Discovered.

		No. of Fires	Per Cent
Employees		97	44.0
Outsider		31	14.1
Sprinkler alarm, central station supervisory		49	22.3
Sprinkler alarm to fire department		8	3.6
Local sprinkler alarm		10	4.6
Heard by watchman	6		
Heard by employee	2		
Heard by outsider	2		
Watchman		19	8.7
Thermostats		6	2.7
Total known		220	100.0
No data		34	
Total		254	

Time of Alarm.

While fires during working hours predominate because of the occupancy hazards previously mentioned, many fires occurred after the plant was closed, due to sparks in coffee chaff or in spices which often smoulder for several hours before fire is evident.

Time of Alarm.

	No. of Fires	Per Cent
6 A.M.—12 Noon	69	28.5
12 Noon—6 P.M.	77	31.8
6 P.M.—12 Midnight	59	24.4
12 Midnight—6 A.M.	37	15.3
Total known	242	100.0
No data	12	
Total	254	

Fires in Which There Was Loss of Life.

Third Quarter, 1936.

Since the publication of the July QUARTERLY, the N.F.P.A. Department of Fire Record has received from various sources 115 reports of fires in which there has been loss of life. A total of 213 lives were lost in these fires. Fires causing five or more fatalities occurred as follows:

JULY 22, 1936, CHICAGO, ILL. Five persons were fatally injured and five others were hurt when a terrific explosion of an undetermined cause demolished a fur cleaning and dyeing plant.

AUGUST 1, 1936, DOWELL, ILL. Nine men were asphyxiated by carbon monoxide fumes while fighting a fire which started in the mine when a newly installed transformer exploded. Men equipped with oxygen helmets were erecting a barricade to confine the fire, when the gas swept by them to the unhelmeted victims who were passing up materials.

SEPTEMBER 2, 1936, LOGAN, W. VA. Ten men lost their lives when a gas explosion occurred in the mine from an unknown cause. Four of the fatalities were due to the explosion and six were from resulting fumes.

International.

Firemen fighting fire in débris of a fur cleaning plant in Chicago, wrecked by an explosion of undetermined origin on July 22, 1936, with a loss of five lives and injuries to at least five other persons.

International.

Three persons were killed and five others injured when their ranch home at Lodi, Calif., was completely demolished by a gas explosion and fire on July 16, 1936. The explosion occurred when one member of the family went to the basement to light a gas heater. An automobile overturned by the blast is in the background.

SEPTEMBER 6, 1936, PITTSBURGH, PA. Ten persons were killed when a tri-motored sightseeing plane crashed on a hillside and burst into flames after a ride of but two miles. One young woman passenger was the only occupant who escaped.

Loss of Life Fires, July-September, 1936.*

This is a typical rather than a complete record, presented to show the conditions under which loss of life occurs, that they may be known and guarded against. The total loss of life by fire in the United States is estimated at 10,000 annually.

Fires in Buildings:	No. Fires	Men	Women	Children	Total
Apartments, hotels, lodgings, tenements, etc...	5	4	0	1	5
Barns and stables	3	0	0	4	4
Dwellings—Rural	28	8	13	21	42
Dwellings—Urban	31	9	15	10	34
School	1	2	0	0	2
Manufacturing occupancies	3	8	1	0	9
Mercantile occupancies	3	6	0	0	6
Multiple stores and dwellings	3	1	2	0	3
Other known buildings	3	3	0	2	5
Fires Outside of Buildings:					
Airplanes and balloon	9	17	6	0	23
Automobiles and trucks	9	8	8	4	20
Tank trucks	2	1	2	0	3
Forest or brush fire	2	2	1	0	3
Oil well	1	5	0	0	5
Out-of-door fires (bonfires, etc.)	4	6	0	9	15
Ships and boats	2	1	1	0	2
Mining property	6	28	0	0	28
Response to alarms	2	4	0	0	4
Total	115	113	49	51	213

*This table is made up from those reports received by the Department of Fire Record between June 21, 1936, and September 18, 1936. A few of the fires included herein occurred prior to June 21, but were not reported until subsequent to that date.

Causes of Loss of Life, July-September, 1936.

Fatalities classified according to the immediate cause of the loss of life rather than according to the cause of the fire.

	Men	Women	Children	Total
Airplane and balloon fires	17	6	0	23
Automobile and truck fires	7	8	4	19
Automobile tank trucks	1	2	0	3
Boat and ship fires:				
Motor boat explosions	1	1	2	4
Children alone in house	0	0	2	2
Children playing with matches	0	0	7	7
Clothing ignited:				
Bonfire, grass or rubbish	1	0	2	3
Fireplace or open grate	0	1	0	1
Furnaces, stoves and heaters	0	4	2	6
Greasy clothing ignited by electric wire	0	1	0	1
No data—clothing ignited	0	2	0	2
Electrical burns	1	0	0	1
Entering or re-entering burning buildings	1	0	0	1
Escaping from fire—jumped or fell	1	1	0	2
Explosions (miscellaneous):				
City gas (including appliances)	1	1	2	4
Ethylene gas in fruit ripening room	4	0	0	4
Explosion while cutting gas container	1	0	0	1
No data—explosion	0	1	0	1
Fire fighting—civilians	1	0	0	1
Fire fighting—firemen	3	0	0	3
Firemen killed by explosion of gasoline by incendiary	3	0	0	3
Fighting forest or brush fires	1	0	0	1
Fireworks	2	0	2	4
Flammable liquids and vapors:				
Alcohol stove overturned	0	1	0	1
Asphalt heating tank exploded	2	0	1	3
Benzol unloaded from tank car exploded	3	1	0	4
Filling gasoline tank near lantern	1	0	0	1
Gasoline lamp or stove exploded	2	1	3	6
Gasoline used to remove bandages ignited by heater	2	0	0	2
Gasoline used to destroy ant hill	0	0	1	1
Home dry cleaning	2	2	0	4
Oil lamp or stove	0	1	2	3
Oil well	5	0	0	5
Paint remover ignited	1	0	0	1
Starting fires with kerosene	2	1	0	3
Motion picture film in dwelling ignited	0	1	0	1
Mine fires and explosions	28	0	0	28
Overcome by smoke—suffocation	1	2	2	5
Overexertion or excitement	0	1	0	1
Response to alarms	4	0	0	4
Smoking in bed	4	4	0	8
Trapped in burning buildings	6	4	17	27
Trapped by forest or brush fire	2	2	0	4
No data	2	0	2	4
Total	113	49	51	213

Foreign Fires.

The outstanding loss of life fire reported outside of the United States and Canada occurred at Barnsley, Yorkshire, England, on August 6, when an explosion in a coal mine killed the entire night shift of fifty-eight men. Many of the men were killed outright by the concussion and others were suffocated by the gas which followed the explosion.

Typical Loss of Life Fires.

Children and Matches.

L-3757. MONTREAL, P. Q., JULY 29, 1936. A nine-year-old girl was burned to death while playing with other children on the steps of her home. The child's clothing ignited from matches the children were using to melt silver paper.

L-3756. HULL, P. Q., JULY 31, 1936. A five-year-old girl was fatally burned playing with matches. The victim and a baby were left under the care of an older sister while the mother was shopping. The little girl obtained the matches unobserved while her sister was attending to the infant.

L-3754. NEW YORK, N. Y., AUGUST 10, 1936. A six-year-old girl was severely burned and died in a hospital as a result of playing with matches in the kitchen of her home. The entire box of matches ignited and set fire to her clothing.

Cleaning with Gasoline.

L-3765. TOPEKA, KANS., JUNE 24, 1936. A young saleswoman was fatally burned and died a few hours later in a hospital as a result of an explosion and subsequent fire, which occurred when she cleaned clothing with benzine. The victim stated that the explosion occurred when she struck a match to light a cigarette.

Clothing Ignited, Bonfire.

L-3758. MONTREAL, P. Q., JULY 29, 1936. A seven-year-old boy died in a hospital of burns received from a bonfire which he and other boys lighted in a vacant lot. While playing tag the child ran close to the fire and his clothing ignited.

Clothing Ignited, Electric Wire.

H-40990. NEW YORK, N. Y., AUGUST 1, 1936. A young man died in a hospital from burns sustained while unloading liquid asphalt from a tank car in a railroad yard. The victim evidently came in contact with a high tension wire near the tank car, causing his clothing, which was covered with grease and asphalt, to ignite. He was found lying on the ground near the car with his clothing ablaze.

Child's Clothing Ignited, Stove.

L-3755. MONTREAL, P. Q., AUGUST, 6, 1936. While her mother was out of the kitchen for a few moments a four-year-old girl climbed upon a chair

and leaned over a lighted stove. Her clothing ignited and she was fatally burned before the mother could put out the flames.

Flammable Liquids Ignited.

L-3753. MOBRIDGE, S. D., AUGUST 18, 1936. Burns suffered in an explosion of gasoline with which her brother was attempting to destroy an ant hill caused the death of a three-year-old girl. The thirteen-year-old brother poured gasoline into an ant hill in the yard, as he had seen older persons do, and then struck a match, intending to burn out the hill. There was an explosion and the little girl, who was standing close by, was enveloped in flames.

Gasoline Stove Explosion.

L-3766. MISSION, S. D., JUNE 19, 1936. A young mother was fatally burned when a gasoline stove exploded in the farm where she lived. The explosion covered large portions of the victim's body with flaming gasoline.

L-3762. MCGREGOR LAKE, P. Q., JUNE 21, 1936. A man was fatally burned when his camp stove exploded, showering him with gasoline. Clad only in a bathing suit, he immediately dove into a near-by lake, but not before almost the entire surface of his body was burned.

L-3761. NEAR CODY, WYO., JULY 18, 1936. One Boy Scout was fatally burned and another was seriously burned when the tank of a gasoline stove, over which one of the troup was frying griddle cakes, suddenly exploded. The boy doing the cooking was uninjured, but flaming gasoline poured over two other boys. They were rushed to a hospital in Cody, thirty miles distant, where one of them died the following morning. The victim's father was present at the time of the accident, but was unable to prevent fatal burns.

Smoking in Bed.

L-3764. CLINTON, MASS., JULY 6, 1936. A prominent business man was found dead in his flaming bed. Death was due to burns and suffocation. Children saw smoke pouring from the window and gave an alarm. The victim's pipe had ignited the bed.

H-40992. TYLER, TEXAS, JULY 10, 1936. A state official fell to his death from his room on the seventh floor of a hotel. The man fell asleep with a lighted cigarette in his hand and it set fire to the bed. Startled by the flames, he evidently jumped through the window before he knew what he was doing.

L-3763. BRISTOL, CONN., JULY 14, 1936. The charred body of a young woman was found in the bedroom of her apartment. The girl fell asleep while smoking a cigarette and was smothered without awakening.

L-3759. AMSTERDAM, N. Y., JULY 27, 1936. A man was fatally burned as a result of smoking in bed and died in a hospital the next day. A neighbor was treated for burns received while trying to beat out the fire in the victim's clothing.

Trapped by Rapid Spread of Fire.

L-3760. HYDES, MD., JULY 25, 1936. A five-year-old boy was burned to death in a straw shed on his grandfather's farm, while his mother and a dozen men stood helplessly by. The boy failed to escape with three playmates who were in the building when the fire started.

H-40989. BROOKLYN, N. Y., AUGUST 6, 1936. A three-year-old boy was burned to death in a fire which wrecked a tenement flat. The boy and a baby sister were left with a neighbor who cares for children at twenty-five cents a day. The fire occurred when the mantel cover ignited as the woman put some kindling in the kitchen stove. The flames spread so rapidly that the woman could save only her own child and the infant. The boy perished in the blazing apartment.

Trapped by Grass Fire.

H-40991. GRAND HAVEN, MO., JULY 20, 1936. A man and his wife were burned to death by a grass fire which swept across a highway and trapped them in their car. A high wind preceding a rainstorm drove the flames toward their farm house. They attempted to escape to the main highway in their car. The dense smoke and fire which was driven across the road by the wind caused the man to lose control of the machine and it struck a telephone post. The couple's clothing was ignited and they were fatally burned.

L-3767. KANSAS CITY, KANS., AUGUST 8, 1936. A fire captain collapsed and died, overcome by smoke and heat from a grass fire which threatened a residential section. The victim was one of two firemen trapped for half an hour in a hollow where the smoke was so thick that they could not see the way out. They finally escaped from the hollow and the other fireman left the captain and continued to fight the fire. A short time later it was found that the officer had collapsed.

DRY CLEANERS USED OVER 1,000,000

of these Stickers on their Garment bags

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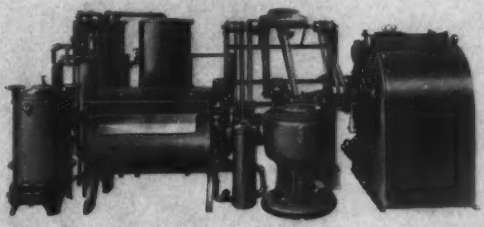

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New type petroleum solvent dry cleaning units complying with regulations of National Fire Protection Association.

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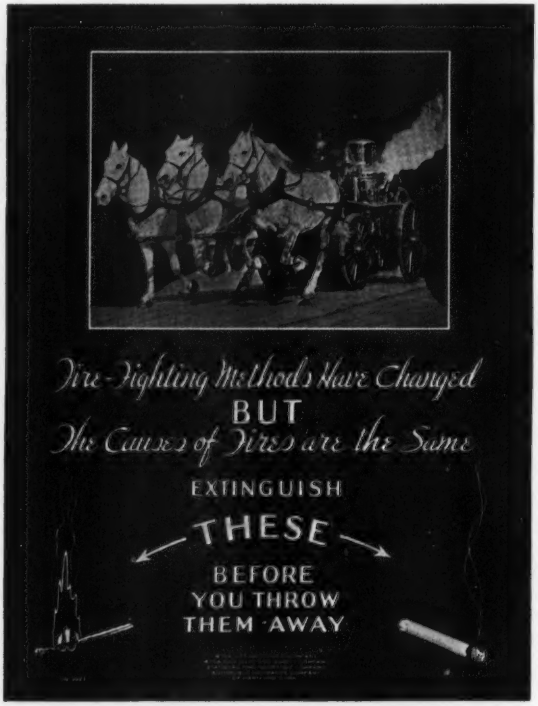

FIGHTING FIRE THROUGH THE PRINTED WORD

REPRODUCED above is a poster, size 8½″ x 11″, widely distributed in the interest of fire prevention. Copies are available upon request.

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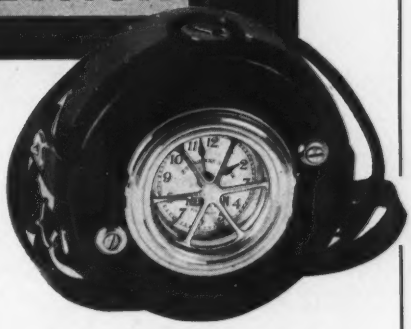

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FIRE DOORS CLOSE Automatically

1. *Fire Starts.*

2. *Dualguard Automatically Releases Fire Door.*

3. *Fire Door Closes and Cuts Off Fire.*

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Tests conducted recently in our fire control laboratory clearly establish the greater speed and efficiency of our new DUALGUARD Fire Door Control over that of the common *fixed* temperature fusible link.

Views 1, 2 and 3 show in progressive steps our DUALGUARD Control automatically closing a fire door within 15 seconds after a test fire was started in six pounds of excelsior. Fire had only traveled to a point six feet from the door when the DUALGUARD Control closed the door and stopped the fire from entering the next room.

4. *Scene Before Fire. Note Dualguard Apparatus.*

This remarkable speed is possible because the DUALGUARD Fire Door Control operates on the *rate of temperature rise.* Starting at any existing temperature, it will operate in just a few seconds after fire breaks out and will close the door before a very rapidly spreading fire can pass through the opening. In contrast, the *fixed* temperature fusible link must wait until heat rises to a predetermined point high enough to melt the link.

DUALGUARD is the solution to your fire door control problems. Write for our descriptive folder Q31.

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IN THE ENGINEERING OF
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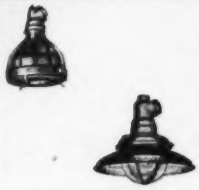
Class I, Group D Atmospheres containing gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors, and natural gas.	Dry cleaning plants, petroleum refineries, bulk oil stations, gasoline filling stations, gas plants, spray painting establishments, dip tank painting processes, chemical plants, artificial silk factories, pyroxylin plastic factories, fabric and paper coating plants, the rubber industry, the leather and shoe industry, soap factories, etc.	
Class II, Group G Atmospheres containing grain dust.	Flour mills, feed mills, grain elevators, starch plants, sugar cocoa and coal pulverizing plants and establishments or industries involving similar hazardous processes or conditions.	
Class III Locations in which easily ignitible fibres or materials producing combustible flyings are handled, manufactured or used and which are hazardous through such fibres or flyings collecting on or being ignited by arcing contacts, resistors, lamps or similar apparatus.	Cotton and other textile mills, combustible fibre manufacturing plants, cotton gins, clothing manufacturing plants, cotton-seed mills, wood-working plants, and establishments or industries involving similar hazardous processes or conditions.	
Class IV Locations in which easily ignitible combustible fibres are stored or handled and which are hazardous through such fibres being ignited by arcing contacts, resistors, lamps, or similar apparatus.	This class may include locations such as warehouses in which are stored or handled combustible fibres such as cotton (including cotton linters and cotton waste), sisal or henequin, ixtle, jute, hemp, tow, cocoa fibre, oakum, baled waste, kapok, Spanish moss, excelsior, and other similarly readily ignitible fibres.	

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SPECIALIZED CONTROL . .

Westinghouse control apparatus for Fire Pumps conforms to the specifications of the National Board of Fire Underwriters.

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1. No live parts exposed.
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● Men interested in safety appreciate the built-in safety features of Westinghouse motors. They see the sturdy frame construction and rigid end-brackets that insure extra mechanical strength. They know that the over-size bearings mean dependability. They find that Westinghouse dual insulation protects the windings from moisture and dust — and that the Radio Test (exclusive with Westinghouse) gives double assurance of perfect insulation.

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GAS SUITABLE FOR PROCESSING

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The picture at the left represents a fire at a large St. Louis hospital on July 15. This fire started at night in a storage room in an infrequently visited part of the basement. Here, also, there was no human being nearby to discover it—yet this fire was put out by the fire department with only a chemical hand extinguisher, with total damage estimated at less than $5.00. Why? It was DISCOVERED AUTOMATICALLY, WHEN IT STARTED, BY THE A. D. T. AERO AUTOMATIC FIRE ALARM.

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The efficiency of Aero is proved by its record. During the past ten years fire losses in Aero protected properties have averaged less than three cents per hundred dollars of insurable values.

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